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IDENTIFYING AND MEASURING RESILIENCE FACTORS AMONG CHILDREN WITH PRENATAL SUBSTANCE EXPOSURE IN A TRIBAL NATION AND IN ASSOCIATION WITH COVID-19 MORTALITY

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Identifying and measuring resilience factors among children with prenatal substance exposure in a Tribal Nation and in association with COVID-19 mortality.

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ABSTRACT

Background: Historical and contemporary trauma among Native Americans is linked to disparate health outcomes across the lifespan including the very recent coronavirus 2019 (COVID-19) outbreak. Early and prolonged exposure to positive family-child engagement activities and the natural environment (greenspace) act as protective factors against a range of maladaptive development across the lifespan. Yet, little is known regarding specific activities relevant among high-risk families in Tribal Nations and no evidence exists in terms of measuring that impact of greenspace against risk of COVID-19 mortality.

Purpose: 1) Partner with a Tribal Nation to develop a study to identify resilience promoting factors in early childhood in the context of prenatal substance exposure (PSE); 2) Identify common positive family-child engagement activities among high-risk families; and 3) Measure the impact of greenspace and risk of COVID-19 mortality in the United States.

Methods: Community-Based Participatory Research (CBPR), strengths-based, and community-driven approaches were applied to studies one and two. The methodological study (study one; development phase) involved relationship-building to partner with one Tribal Nation and to design an epidemiological study. The qualitative study (study two; phase I) consisted of in-person semi-structured interviews with caregivers to children, ages 0-3 years, with and without PSE to identify common activities, and barriers, facilitators, and positive child outcomes to activities. The quantitative study (study three; phase II) measured greenspace exposure by leaf area index (LAI) deciles derived from 2011-2015 averaged 250 m resolution annual maximum LAI maps to assess a dose-response association with COVID-19 mortality.

Results: Study one yielded the development of a successful partnership with a Tribal Nation and a robust study design. Study two identified common cultural, community, outdoor and home activities that children engaged in with their family. Common barriers and facilitators overlapped in terms of cost, adequate transportation, safety, and family or friend presence. Positive outcomes for children were gaining cultural knowledge, bonding opportunities, and feeling soothed. Study three indicated a dose response association between high levels of LAI and lower mortality due to COVID-19.

Conclusion: Studies one and two demonstrated the impact of CBPR in engaging in research with a Tribal Nation. Study three provided evidence of a protective effect of greenspace exposure and risk of COVID-19 mortality. This research lays the groundwork for a future study that will quantify the impact of these resilience factors against social-emotional development among young children with and without PSE.

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CHAPTER 1: BACKGROUND

1. Introduction and Rationale

Tribal Nations are sovereign nations that are recognized by the federal government as having the right to self-govern to enact tribal laws and policies within their communities.[1] They have historically experienced a range of policies that have led to genocide, forced assimilation and neglect.[2] Such policies have had debilitating consequences for the few remaining tribes including tragic and substantial impacts on health and wellbeing. Native populations continue to fare worse across a range of health indicators compared to other races.[1,3-5] The consequences from the horrific historical traumas that are omnipresent among Native Americans partly explain why Native populations continue to experience significant health disparities. Two of these—early childhood impacts of prenatal substance exposure and mortality due to 2019 coronavirus disease (COVID-19)—are the focus of my doctoral dissertation.

Nationwide, the number of Medicaid-enrolled infants born with neonatal opioid withdrawal syndrome (NOWS) – the withdrawal (e.g., tremors) syndrome that newborns can experience due to *in utero* exposure to opioids – increased five-fold from 2004 to 2014, from 2.8 (95% CI, 2.1-3.6) to 14.4 (95% CI, 12.9-15.8) per 1,000 births.[6] Native American infants experience higher rates of NOWS compared to non-Hispanic white, black and Hispanic counterparts.[7] Prenatal methamphetamine and opioid exposure among newborns increases risk of neurobehavioral deficits in long-term learning and memory, and externalizing (e.g., aggression, hyperactive, disruptive) and internalizing (e.g., anxious, withdrawn, depressed) behaviors.[8-10]

The global COVID-19 pandemic resulting from the highly transmissible and pathogenic severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has spread rapidly across the world since December 2019. Native Americans are primarily at heightened risk of death from

contracting COVID-19. As of June 2020, the age-adjusted COVID-19 mortality rate among Native Americans was found to be 1.8 (95% CI: 1.7-2.0) times higher compared to their non-Hispanic White counterparts and is likely higher due to concerns of missing and inaccurate race/ethnicity data.[11] This is not surprising as several risk factors for COVID-19 death (e.g., chronic health conditions, household overcrowding and air pollution, poverty, limited healthcare access due to underfunding, limited healthy food access) are also highly prevalent among Native Americans.[12] In addition, current genetic susceptibility and innate immune responses to novel viral infections remains akin to our pre-Columbian ancestry which place Native Americans at greater risk of susceptibility to COVID-19 and other novel respiratory viruses.[12] To combat the devastating effects from this virus several Native American groups are taking important steps to mitigate transmission of the virus by promoting curfews, social isolation, personal hygiene, and cultural-responsive healthcare preparedness efforts in which specific recommendations include frequenting the outdoors with the intent of connecting with the land, for example.[12,13]

It is common for researchers to focus on deficits in studies of health disparities in Native Americans. The research described here is innovative in that it applies a strength-based approach. Rather than emphasizing risk, we focus on two potentially resilience-promoting factors—family engagement and greenspace exposure—as instruments to address health disparities. Specifically, this project used a community-based participatory research (CBPR) approach to: 1) partner with a Tribal Nation to *design* a strengths-based epidemiological study aimed at resilience in the context of prenatal substance exposure, 2) identify resilience-promoting activities, barriers, supports and positive child outcomes among caregivers of children with and without prenatal substance exposure in a Tribal Nation, and 3) quantify the association between greenspace exposure and risk of COVID-19 mortality across the United States.

2. Background

2.1 Consequences of historical and contemporary trauma

Natives, particularly Native women, have experienced both historical and contemporary traumas that are linked to adverse outcomes. Assimilation of Native people into mainstream society is synonymous with historical trauma. Clinician and researcher, Maria Yellow Horse Brave Heart, succinctly summarizes historical trauma as the, "…cumulative emotional and psychological wounding, over the lifespan and across generations, emanating from massive group trauma experiences." (P. 7)[14] The loss of traditional transference of knowledge and practice can be partly attributed to forced attendance in boarding schools that has led to significant detrimental outcomes across generations of tribal people including the spread of uncommon diseases, substance misuse, depression, suicide and domestic abuse.[15]

2.2 Prenatal substance exposure

Opioid and poly-drug misuse among pregnant women is an increasing epidemic in the United States prompting major public health concern due to associated risk in pregnancy complications, cognitive and behavior deficits among in utero drug-exposed offspring, and economic burden placed on healthcare facilities due to receipt of healthcare services primarily consisting of inpatient stays.[16] Native adult and youth women that experience intimate partner violence or were exposed to violence were more at risk for depressive symptoms, comorbidities, and drug problems which can lead to unplanned pregnancies.[17,18] Consequentially, there is a general growing trend of infants being born with prenatal substance exposure.

Neonatal abstinence syndrome (NAS), which overlaps with neonatal opioid withdrawal syndrome (NOWS), but also considers the impact of non-opioid substances on the fetus, exhibits a wide range of clinical features such as fever, vomiting, poor feeding, tremors, irritability and

may result in admission to a neonatal intensive care unit, pharmacological treatment, disrupted bonding, and/or a longer hospital stay.[19] NAS has risen dramatically across the United States. From 2010 to 2017, the NAS rate and the maternal opioid-related diagnosis rate had respective significant increases from 4.0 to 7.3 per 1000 birth hospitalizations, and from 3.5 to 8.2 per 1000 delivery hospitalizations, respectively.[20] Factors explaining the rise in NAS/NOWS are partially due to the marked increase in prescribing opioids for pain management, illicit use of opioids, and opioid substitution programs (e.g., medication-assisted treatment) for pregnant women.[19] In addition, long-term behavioral consequences among children born with NAS/NOWS can be partly explained by the "fetal origins hypothesis" (also called the Barker hypothesis), which is a programming theory that posits having non-matching prenatal and postnatal environments leads to negative health consequences.[21] A study among children with prenatal substance exposure and risk of externalizing (e.g., overactivity, aggression, and defiance) and internalizing (e.g., anxiety and depression) problem behaviors applied this hypothesis in that the highly stimulating prenatal environment due to *in utero* drug exposure would not match with the anticipated low stimulating postnatal environment due to the absence of drug exposure and would lead to child maladaptive functioning.[22] This hypothesis was confirmed in that prenatal exposure to methamphetamine or cocaine status was positively associated with internalizing and externalizing problem behaviors.[22] Early intervention for children with prenatal substance exposure with the goal of mitigating long-term consequences is warranted.[23]

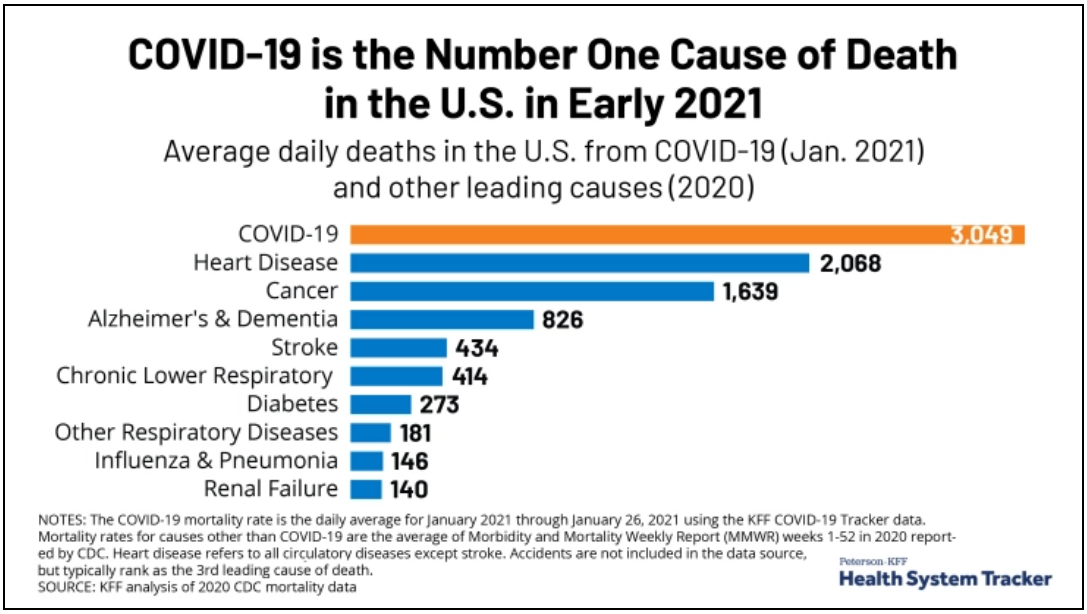
Research has indicated a need to quantify the effect of parent involvement to measure the protective impact for children with NAS.[24] Promising studies indicate that early intervention among Indigenous children with plausible prenatal substance exposure demonstrate significant gains in social-emotional behaviors post-intervention.[25] Of concern, is that Indigenous

communities have been historically underrepresented in studies on personal, community and cultural strengths among families.[26] To date, there are limited, if any, studies that have measured the impact of positive family-child engagement with the intention of assessing behavioral development among children with prenatal substance exposure that reside in a Tribal Nation. The contribution of this research is expected to be significant in that it will inform future work evaluating culture-sensitive and community-relevant positive family-child engagement activities that may indicate a protective effect against behavioral dysfunction among children with prenatal substance exposure that reside in a Tribal Nation. First, research is needed to identify which common positive family-child engagement activities occur among this target population.

2.3 COVID-19

COVID-19-associated deaths ranked highest in the United States in early 2021 as the leading cause of death compared to heart disease, cancer and other leading causes of death (see Figure 1) according to a recent report from the Kaiser Family Foundation.

Figure 1. COVID-19 as the leading cause of death in the United States, January 2021. *Source*: *https://www.kff.org/coronavirus-covid-19.*



Numerous factors have been shown to increase susceptibility to severe COVID-19. Clinical features among patients with severe cases of COVID-19 consisted of being older in age, having chronic conditions (e.g., hypertension, cardiovascular disease), experiencing shortness of breath, fatigue, and having unhealthy levels of inflammatory cytokines, infection-related biomarkers indicating a dysregulated immune system.[27] Several studies have shown several clinical, demographic, and environmental risk factors for COVID-19 mortality including chronic diseases (e.g., hypertension, diabetes, or coronary heart disease), being immunocompromised or having abnormal immunity, older in age, male sex, having a disability, Black or Native American, poverty, public insurance (e.g., Medicaid), obesity, poor air quality, overcrowding in home, and education attainment.[28-34] Natives, in particular are at heightened risk of susceptibility and death due to COVID-19 due to a high prevalence of chronic health conditions, overcrowding and air pollution in the home, poverty, underfunded healthcare, limited healthy food access, lack of running water, and genetic susceptibility[11,12] Historically, Natives have disproportionately relied on only one health resource, the Indian health Service (IHS). IHS is made available through government appropriations and services are contingent on adequate funding (https://www.ihs.gov/ihm/).

This pandemic has provided the opportunity to evaluate the impact of a specific resilience factor, greenspace, on mortality due to COVID-19. Of the current studies assessing the impact of COVID-19, none has measured the association between greenspace exposure and risk of COVID-19 mortality. This is especially timely given what we know about the impact of climate change on our ecosystems which harms ecosystem ecology and leads to infectious disease outbreaks. The contribution of this research is significant because it may encourage more individuals to frequent the outdoors more often and encourage their children to spend more time

outdoors which is evidenced to have a reduced risk of a range of adverse health outcomes. The subsequent section details supporting hypotheses for respective resilience exposures.

2.4 Resilience among Native American Populations

There is a paradigm shift occurring in research with Native American populations. We are seeing a movement towards strengths-based study designs, which emphasizes measuring exposures that confer positive outcomes.[35] Resiliency is generally defined as a protective buffer when a person experiences a stressful life event that would prevent or attenuate psychological distress.[36] Indigenous populations are diverse in their culture, tradition and communities. We describe the resilience factors of primary interest to my doctoral research below.

2.5 Resilience Factor: Early Family-Child Engagement

Early childhood intervention is critical to attenuate or prevent symptom exacerbation of internalizing and externalizing behaviors and developmental dysfunction, and promote self-regulation, academics, and developmental milestones.[37-39] A recent review of the literature using a combination of "prenatal substance exposure" and "caregiver engagement" or "familial connectedness", and "behavior" or "child behavior" terms in the PubMed and PsycInfo database platforms yielded zero returns indicating there are little, if any, studies that assess familial or parental involvement as a protective factor against behavioral problems among children with prenatal substance exposure. The lack of results is somewhat concerning given that positive familial or parental engagement is a well-established protective factor in overall child behavioral outcomes.[38-42] In addition, Indigenous communities can be a source of resilience and resistance to encourage long-term wellbeing among youth by promoting a sense of family connectedness and engagement in cultural practices.[40]

In a large-scale randomized-control trial among pregnant Native teenagers participating in Family Spirit, a federally-endorsed, culturally congruent home-visiting intervention from their respective tribal communities, authors found that children born to mothers with a history of alcohol, marijuana, or illicit substances demonstrated greater improvements in emotional and behavioral outcomes after receiving the home-visiting intervention compared to children that had mothers without a substance use history receiving the same intervention and their counterparts that did not receive the intervention.[25,43] It is also noteworthy that Family Spirit is the only evidence-based home visiting program developed for pregnant and parenting Native American families.[44]

A longitudinal study that measured the influence of family connectedness, ethnic identity, and ethnic engagement on wellbeing, such as having positive relations with others, among youth that identified as Māori found that both quality of family connectedness and engagement with their culture and practices predicted wellbeing at baseline and remained positively associated with wellbeing over time.[40] A randomized clinical trial was conducted to assess the impact and cultural relevance of the adapted Group Triple P, an evidence-based positive parenting program.[45] Outcomes of interest were findings of reported significant decreases in the count and intensity of disruptive problem behaviors among children post-intervention whose parents had participated in the culturally-adapted Group Triple P intervention.[45]

Family connectedness has several underlying mechanisms that are postulated to explain the robust positive impact on child social-emotional behavioral development. For example, family meals promote opportunities for parents or caregivers to check-in on their child regarding their emotional wellbeing, and spending more time with family may also reduce opportunities for youth to engage in risky behaviors with peers.[46] In general, family connectedness encompasses

behaviors and activities that promote feelings of trust, understanding, and support among children and demonstrates strong positive associations with child social-emotional behavioral wellbeing.[47] Of particular interest is the setting where family-child engagement occurs. The natural environment holds multiple human health benefits.

2.6 Resilience Factor: Early and Continued Greenspace Exposure

Exposure to greenspace, such as parks and forested areas, has been found to support positive child development and act as a protective buffer against later chronic conditions, morbidity and mortality. Early and continued greenspace exposure has been associated with improved cognition, memory and attentiveness among children.[48-52] Underlying mechanisms of the impact of greenspace exposure on positive child development may include psychological benefits, social contact, physical activity and improved air quality.[53] Pathways linking greenspace to human wellbeing have been categorized into three domains that consist of reduced harm from environmental stressors (e.g., air pollution, noise, heat), restorative capacities (e.g., attention restoration, stress recovery), and building capacities (e.g., physical activity, social cohesiveness).[54]

Concerning findings indicate children are spending less time outdoors compared to their parents and use of mobile media devices (e.g., tablet, smartphone) doubled from 2013 compared to 2014.[55,56] In addition, approximately 4% of forests were lost from 2001 to 2016 in the conterminous United States.[57] The rise in pollution and diminishing greenspaces has also led to the loss of biodiversity which further compounds reduced opportunities for human-environment interactions.[58]

Greenspace and child development. To date, several studies have measured the association between greenspace and human development. One study conducted in the United

States followed children and youth over time and measured residential greenspace exposure and parent-reported externalizing (e.g., aggression, conduct) and internalizing (e.g., anxiety, depression, somatization) behavior status.[59] Results indicated a dose-response relationship between residential greenspace exposure and decreased conduct scores among children, and decreased anxiety, depression and somatization among youth.[59] A New Zealand study in children younger than 18 years of age found that rural residence and greenspace exposure have a significant protective effect against ADHD.[60] A large-scale study in Denmark followed children over time to measure residential greenspace exposure and later development of psychiatric disorders.[61] A significant dose-response relationship occurred for mean- and cumulative-greenspace exposure with children at the lowest greenspace decile having the highest risk of developing the following psychiatric disorders: specific personality disorder, eating disorder, obsessive compulsive disorder, neurotic-stress and -somatic disorder, single and recurrent depressive disorder, mood disorder, schizophrenia, substance use (e.g., cannabis, alcohol), substance abuse, etc.[61] A large-sample study in Spain followed two age cohorts of children over time until ages 4-5 and age 7, respectively to measure residential greenspace exposure and child attention.[48] High lifetime exposure was associated with reduced omission errors, a measure of focused attention, among children ages 4-5 years, but not for their 7-year old counterparts.[48] These studies add to the literature on the protective impact of early and prolonged exposure to greenspace against later developmental disorders.

Greenspace and infectious disease. Experts across various fields that measure greenspace have indicated an increased risk and spread of infectious diseases due to the diminishing natural environment. COVID-19 severity and mortality are linked to several environmental factors, including air pollution, through means of negatively impacting the human

immune system.[62,63] The natural environment provides exposure to microbial diversity through soil, plants, and wildlife,[53,58,64-68] which promotes enhanced immune functioning by introducing positive factors (e.g., mycobacterium vaccae microorganism) and removal and prevention of negative factors (e.g., air pollution, immunoregulation disorders, inflammatory diseases).[58,64] The "biophilia hypothesis" posits that humans have an innate relationship with the natural environment through an evolutionary bond to nature and other forms of life indicating that there are a variety of mechanisms through which greenspace promotes overall human wellbeing.[69]

Early and long-term exposure to greenspace may improve immune function and decrease risk of mortality from the novel coronavirus disease-2019 (COVID-19).[53,66-68] In addition to improved immune function, greenspace exposure may reduce mortality due to COVID-19 by reducing air pollution exposure.[29,70] A combination of early exposure to environmental factors, genetics, and diet were posited to collectively contribute to a diverse gut microbiota, which promotes enhanced immunity against clinical adverse outcomes from COVID-19.[65]

Several studies recommend measuring greenspace as a protective factor in a way that demonstrates human-environment interaction rather than passive measures. For example, one large-scale study in Rome measured greenspace via leaf area index (LAI) and normalized difference vegetation index (NDVI) where NDVI is the visible and near-infrared light reflected by vegetation, and LAI is the leaf surface area per unit ground surface area that also provides biological significance by representing the quantification of layers of vegetation.[71] The study found a reduced risk between increasing exposure to both residential LAI and NDVI against stroke, nonaccidental mortality, and cardiovascular- and cerebrovascular-specific mortality.[71] Greenspace definitions and measurements differed across all studies discussed here. Researchers need to carefully consider the operational definition, how to measure and what to measure

keeping in mind the research context to enable integration across studies and opportunities for meta-analysis.[66] However, understanding protective factors that exist within one Native community requires meaningful partnership and careful measurement which may lead to unique operationalization of protective factors to understand the complex constructs that comprise resilience.[72] Measuring greenspace that confers human-environment interaction is also warranted.[53]

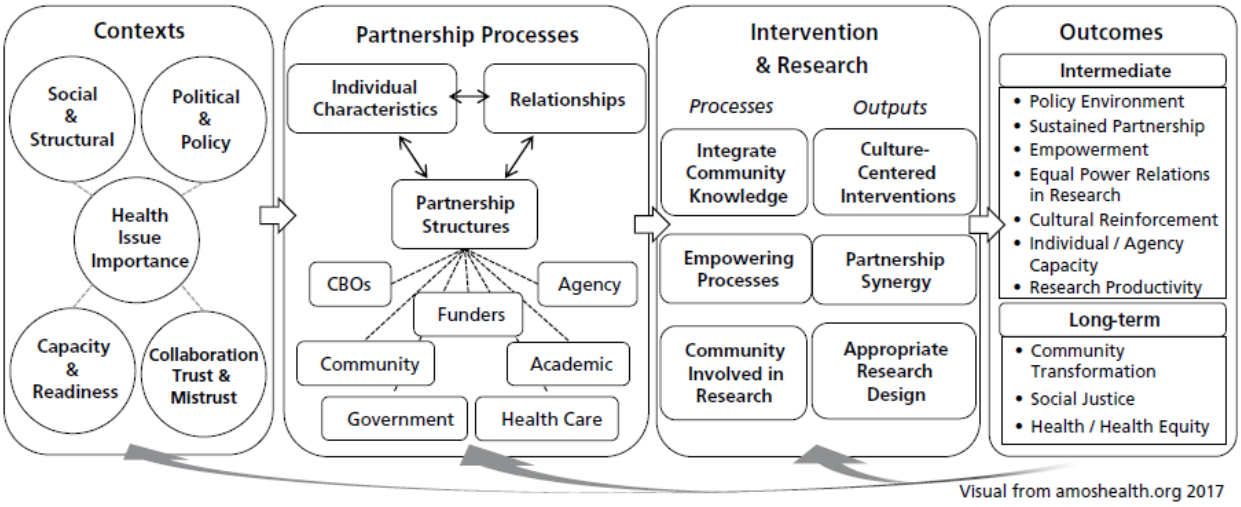
2.7 Community-Based Participatory Research to Study Resilience

Theoretical models are often developed and supported among non-Native populations and may not always be relevant or appropriate to apply in Native populations.[26] However, Community-Based Participatory Research (CBPR), strengths-based, and community-driven approaches when conducting research with Indigenous populations in general holds several benefits.

A primary component of CBPR is the principle of building on the strengths and resources of a community by leveraging existing community interventions.[73] Critical theory et al. and constructivism paradigms are particularly applicable to CBPR in that critical theory et al. places perspective of reality in the context of social, political, economic, cultural, ethnic, and gender factors, and constructivism posits that there are multiple, socially constructed realities for individuals that are influenced within social, cultural and historical contexts.[74] CBPR is intended for studies that aim to improve the health and wellbeing of communities and to prevent and reduce health disparities.[73] Figure 4 summarizes the logic model that makes up CBPR that is organized into the following domains: contexts, partnership characteristics and processes, research and intervention designs, intermediate and long-term outcomes.[75] *Contexts* take into account the social-structural (e.g., social-economic status), political policy (e.g., local

governance), health issue (e.g., perceived severity among community partners), collaboration (e.g., acknowledge historic mistrust), and capacity (e.g., partnership capacity); *partnership processes* include partnership structures (e.g., diversity to indicate who is involved), individual characteristics (e.g., motivation to participate), and relationships (e.g., safety, respect, trust); *intervention and research* involve several processes (e.g., honoring of community and cultural knowledge and voice) and outputs (e.g., culture-centered interventions); and, *outcomes* consists of the intermediate system and capacity outcomes (e.g., sustainable partnerships and projects) and long-term outcomes for social justice (e.g., community/social transformation via policies, programs or conditions). (Pp. 82-83)[75]

Figure 4. Conceptual logic model of Community-Based Participatory Research: Processes to Outcomes. (*Source: Wallerstein et al., 2008. Visual from amoshealth.org (2016).)*



Select rationale for incorporating CBPR into the first two studies are the following:

- enhances the relevance and usefulness of the data between parties,
- joins people with varying knowledge and expertise to address a problem,
- improves research quality and validity based on lived experience to the community,
- strengthens research capacity and program development,

- creates theory derived from social experience,
- aims to improve health and wellbeing among the community through identifying and addressing needs and by increasing power and control over the research process and,
- most importantly, promotes meaningful involvement of marginalized communities typically occurring by race, gender, and class with the intent of eliminating disparities. (Pp 180-181).[74]

One study summarized Indigenous-specific CBPR principles providing several recommendations[76] that were incorporated into the first two studies described herein. Such principles emphasize acknowledging historical experience, recognizing tribal sovereignty, differentiating between tribal and community membership, understanding tribal diversity and its implications, planning for extended timelines, recognizing key gatekeepers, preparing for leadership turnover, interpreting data within the cultural context, and utilizing Indigenous ways of knowing.[76] Application of these principles can be found in detail in chapter 2. Specific study aims for my dissertation are presented below.

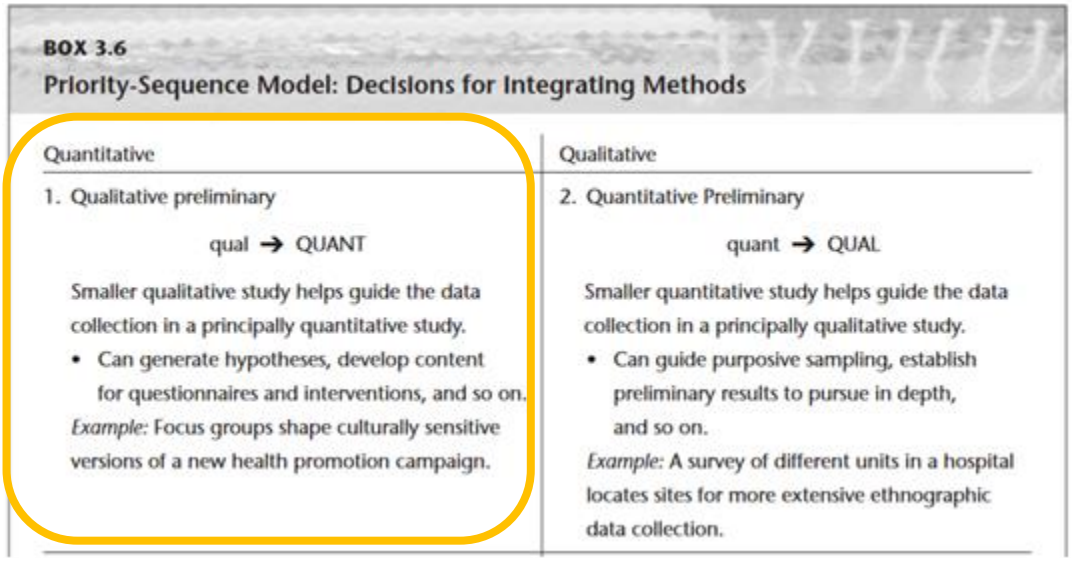
3. Specific Aims

Specific Aims and Research Questions. All respective studies are completed. The overall goal for this project was to identify and measure resilience factors that may improve health and wellbeing.

Aim 1 (chapter 2). **Partner with a Tribal Nation to develop an epidemiological study of resilience-promoting factors in the context of prenatal substance exposure**. The study question asked was, "what is the capacity for one Indigenous community to engage in epidemiological research centered on a sensitive topic with a highly stigmatized population?" CBPR, strengths-based, and community-driven approaches were applied to complete this aim in

Summer 2017. The Confederated Salish and Kootenai Tribes (CSKT) Early Childhood Services (ECS) agreed to be a research partner. This study identified the need first for a qualitative study (see Figure 5) prior to the quantitative study due to CBPR-related activities as shown in Figure 4[75] which is a recommended practice when conducting research with Indigenous communities.[77] The application of CBPR when engaging in research with Tribal Nations has evidenced to improve the efficacy of interventions.[77] Taking this approach allowed for the careful identification and measurement of variables that were determined relevant and important to the participating Tribal Nation in the qualitative study (chapter 3).

Figure 5. Overarching Conceptual Study Design. *Source: Tolley et al. (2016).*[78]



BOX 3.6

Priority-Sequence Model: Decisions for Integrating Methods

Quantitative	Qualitative
1. Qualitative preliminary	2. Quantitative Preliminary
qual → QUANT	quant → QUAL
Smaller qualitative study helps guide the data collection in a principally quantitative study. • Can generate hypotheses, develop content for questionnaires and interventions, and so on. *Example:* Focus groups shape culturally sensitive versions of a new health promotion campaign.	Smaller quantitative study helps guide the data collection in a principally qualitative study. • Can guide purposive sampling, establish preliminary results to pursue in depth, and so on. *Example:* A survey of different units in a hospital locates sites for more extensive ethnographic data collection.

Aim 2 (chapter 3). **Identify positive family-child engagement activities and what barriers, facilitators and child positive outcomes might exist related to common activities among families to children with and without prenatal substance exposure using semi-structured interviews (n=15).** The study question asked was, "what common activities exist and what are the barriers, facilitators and positive child outcomes related to activities exist among families to

young children with and without prenatal substance exposure across the community, culture, outdoors, and home settings?" Common activities identified from interviews will inform a tool to quantify family-child engagement in a future study.

Aim 3 (chapter 4). **Investigate the impact of greenspace exposure on COVID-19 mortality in the conterminous United States (n=3,049 counties).** The study asked question was, "is greenspace exposure protective against death due to COVID-19 and are LAI deciles a feasible greenspace metric to measure a dose-response association?" Exposure to the natural environment may be protective against risk of COVID-19 mortality due to enhanced immunoregulation and improved air quality. Greenspace was measured using LAI deciles to determine if a dose-response association existed similar to another study.[61] The manuscript pertaining to Aim 3 has been published in *Environmental Research*. The third study (chapter 4) will also evaluate the feasibility of leaf area index (LAI) deciles as an approach to ascertain greenspace for future work in Tribal Nations evaluating greenspace as a resilience factor.

> We hypothesize that higher county-level of greenspace will be associated with lower county-level COVID-19 mortality rates.

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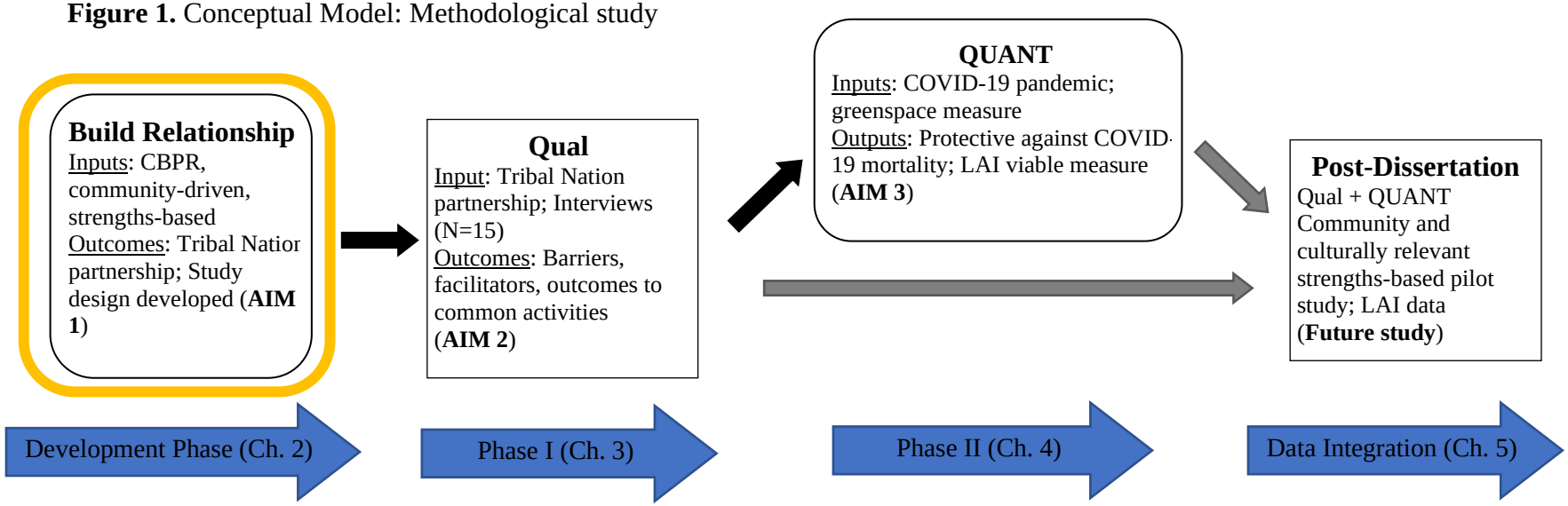
CHAPTER 2

METHODOLOGICAL STUDY 1: Relationship-building to develop an Indigenous community-based epidemiological study investigating developmental resilience factors among children with prenatal substance exposure.

Publication Status:

A modified version of this chapter is *in review* at the Journal of Ethnicity in Substance Abuse. The manuscript submitted to the journal was approved by the Confederated Salish and Kootenai Tribes (CSKT) Tribal Council, Community Advisory Team and CSKT Early Childhood Services. In addition, CSKT Tribal Council approved the use of 'CSKT' in the manuscript.

Figure 1. Conceptual Model: Methodological study



Acronyms: CBPR = Community-based participatory research; LAI = Leaf Area Index; Qual = small qualitative study; QUANT = large quantitative study.

Notes. Overall study uses an explanatory sequential mixed methods design. Data collection occurs in two phases: 1) qualitative interviews and 2) passive sampling of greenspace exposure via LAI deciles to inform future study. Black arrows = paths that comprise the dissertation. Gray arrows = paths that comprise the future study.

Abstract

Background*:* Tribal Nations experience substance misuse at high rates attributed to historical and contemporary traumas. Several efforts that promote recovery and prevention to substance misuse already exist in Indigenous communities. While our overall, long-term research goal is to implement effective and culturally relevant interventions to promote early childhood development in the context of prenatal substance exposure, we recognize that research in Indigenous communities relies on partnership and community engagement at every stage. In this chapter, we describe our research development work to partner with a Tribal Nation on a study. Objectives*:* 1) Successfully *partner* with a Tribal Nation. 2) *Design* a mixed-methods study to evaluate factors that contribute to the wellbeing of families with a history of substance misuse. Methods*:* We applied community-based participatory research (CBPR), strengths-based, and community-driven approaches during a two-year development phase to build a partnership with a Tribal entity and design qualitative (chapter 3) and quantitative (beyond dissertation) studies aimed at identifying family resilience-promoting factors in the context of prenatal substance exposure. We describe the challenges and solutions specific to the study objectives. Results*:* Key factors were familiarizing researchers with the community setting, working with a liaison who is a community member, incorporating Indigenous CBPR principles, and developing a Community Advisory Team. Products of chapter 2 research include successful collaboration with the Confederated Salish and Kootenai Tribes (CSKT) Tribal Nation and a robust study design including a dissemination plan to ensure translation of study findings to the community. Conclusion*:* Our research development groundwork has laid the foundation for future work in this population and may also serve as a template for researchers seeking to work with tribal communities.

Keywords: Community-driven approach; strengths-based approach; CBPR; Native Americans; prenatal substance exposure

Introduction

Disproportionate rates in substance use disorder among Native Americans continue to remain high despite concerted efforts from both Indigenous communities and academic researchers to implement strategies for both prevention and intervention. Recent and lifetime prevalence of substance use disorder were both significantly higher among Native Americans compared to their Asian/Pacific Islander, Black, Hispanic, and White counterparts.[1] In addition, whether in metro and nonmetro locations, Native American adult populations continue to have elevated rates of opioid use disorder and age-adjusted drug overdose deaths.[2,3] In response to these stubborn rates, Tribal Nations and academic researchers have collaborated on impactful research that shows promising interventions for children and families impacted by substance use disorder. One study measuring the impact of a culturally congruent home-visiting intervention across several tribal communities found that children born to mothers with a history of alcohol, marijuana, or illicit substances demonstrated greater improvements in emotional and behavioral outcomes after receiving the home-visiting intervention compared to children who did not receive the intervention.[4,5] Studies such as this demonstrate the potential for a successful bridge between tribal communities and academic researchers.

Community-based participatory research (CBPR) is the "gold standard" for research with Native populations and shifting from a deficits-based to a strengths-based approach helps both the community and researcher to better understand community needs and strengths that make for a well-designed and impactful study.[6] Conducting rigorous epidemiological research with

Indigenous communities is critical to identify and reduce disease burden. Successful partnership may be hindered based on a history of mistrust imposed by researchers. Past researchers have failed to adequately inform Indigenous participants of the study and study findings, and in many cases failed to provide contact information with participants creating a relationship of distrust.[7] Several studies have found incorporating CBPR approaches not only aids in building a community-research partnership, but such approaches enhance study rigor and effectiveness, and promote trust, respect and overall positive collaboration.[8-14]

Community-research partnerships are critical to establish to ensure community participation and to guide measurement decisions that promote an overall effective and robust study design.[12] Efforts from the National Institutes of Health (NIH) continue to support responsible Indigenous health research, such as the Intervention Research to Improve Native American Health (IRINAH) consortium.[15] A need exists to support more rigorous research that holds promising prevention efforts among Indigenous communities.[11] The process to establish a successful research partnership is of paramount concern. A substantial amount of time is often required to avoid adverse consequences. Recommendations during this time-intensive process include, but are not limited to, becoming familiarized with tribal sovereignty, ensuring adequate informed consent, understanding the local code of ethics and intellectual property rights, and ensuring respectful implementation of CBPR approaches, such as obtaining approval through local leadership groups (e.g., culture/elder committees, Tribal Council, local Institutional Review Board) to avoid unintended negative consequences which all aid to promote an equitable partnership.[16,17]

To reach our long-term research goal of implementing an effective and cultural-sensitive early childhood development intervention in the context of prenatal substance

exposure that will occur after this dissertation, we must first recognize that research in Indigenous communities requires partnership and community engagement. In this chapter, we describe our research development work. The specific objectives of the development phase were to 1) successfully partner with a Tribal Nation; and 2) design a mixed-methods study using CBPR, community-driven and strengths-based approaches.

Methods

Figure 1 (see beginning of chapter) conceptualizes the overall doctoral research, study phases in research, how chapter 2 fits into my dissertation, and next steps of this research that occur beyond the dissertation. This chapter summarizes the challenges, solutions, and outcomes to the successful research collaboration between a Tribal Nation and academic researchers. This work is intended for those that wish to conduct community-based participatory research (CBPR) studies on a sensitive subject among a highly stigmatized population within an Indigenous community. Both relationship-building and designing of the study called for the following strategies: 1) becoming familiarized with the Confederated Salish and Kootenai Tribes (CSKT); 2) utilizing expertise and support from our primary sponsor; 3) applying Indigenous CBPR principles to study steps; and 4) establishing a Community Advisory Team.

1. CSKT Tribal Nation: Community setting

It is important to note that each tribal community holds diverse values, languages, and histories.[15] We acknowledge the diversity within CSKT as Native American (native) and non-native researchers. As such, an extensive portion of the study occurred during the development phase to become familiarized with the community. The Confederated Salish and Kootenai Tribes is a Tribal Nation located in northwestern United States. CSKT contains over 10 towns that

range from rural and isolated to non-metro urban. Although the towns are spread apart, and would not necessarily be considered one community, the nature of being in the Tribal Nation creates a unique community ecosystem that includes both native and non-native members from a number of these towns. The community encompasses over 1 million acres and lies within four counties where approximately 5,400 enrolled members reside. This community has several strengths. Strengths related to capacity to engage in research are 1) having tailored early childhood programs and services that families with and without substance use utilize; 2) native language immersion programs available across the life course that are available to children in HeadStart; and 3) two home-visiting programs that have the capacity to implement evidence-based early interventions for children ages 0 – 5 years. The study sponsor, discussed in the subsequent section, was paramount in supporting academic researchers to become familiarized in a respectful and meaningful way with the CSKT community.

2. Research Center and Cores

The American Indian and Alaska Native Clinical and Translational Research Program (AIAN CTRP) is the primary sponsor for the development phase of this study and is funded by the NIH National Institute of General Medical Sciences (NIGMS). The primary goal of the AIAN CTRP is to build research capacity in Indigenous communities and provides the following cores that house resources to investigators: 1) Community Engagement and Outreach; 2) Pilot; 3) Professional Development; and 4) Research Design Epidemiology and Biostatistics. The research team utilized all cores throughout the development phase of this study with primary support occurring from the Community Engagement and Outreach (CEO) Core. Cores support grant application submission, advanced training opportunities, review, and guidance of research

design, and partnering with communities. Core staff are co-located in Alaska and Montana and are accessible to all active researchers funded through AIAN CTRP.

The AIAN CTRP's CEO Core provided direct in-person support by allowing us to work with a dedicated staff person who acts as a community liaison and who is a CSKT tribal member. This person provided several opportunities for research staff to meet with two Tribal Nations that engaged in community-directed programs tailored to the study target population and had families with children impacted by prenatal substance exposure.

3. Application of Indigenous CBPR Principles

The study process contained several steps that demonstrated Indigenous CBPR principles, which were developed in the context of 12 tribes currently residing in Montana on successful ways to partner with tribal communities on a research study to reduce health disparities.[10] Table 1 depicts the nine principles and examples from the current study that align with community participation and collaboration.

Table 1. Application of study activities to Indigenous CBPR Principles.

Indigenous CBPR Principles		**Study Examples**
1. Acknowledge historical experience	→	Local SKC IRB holds primary restrictions and oversight of research.
2. Recognize tribal sovereignty	→	Development awards provides time for study development and community relationship-building.
3. Differentiate between tribal and community membership	→	Involve tribal members in the study design as either key stakeholders or CAT members and co-present to tribal leadership groups.
4. Understand tribal diversity and its implications	→	Present study proposals to tribal leaders and incorporate shared tribal knowledge; participate in community events when invited; collaborate with CAT to develop this article.
5. Plan for extended timelines	→	Receive additional, two in total, development awards to allow for extra time to establish community partnerships.
6. Recognize key gatekeepers	→	Leverage CEO Core support to be introduced to key community stakeholders.
7. Prepare for leadership	→	Draft MOA with primary partner to ensure continuity of

turnover		study.
8. Interpret data within the cultural context	→	Present qualitative study results to tribal leaders for interpretation and context.
9. Utilize indigenous ways of knowing	→	Key stakeholders are Indigenous and/or reside in the Tribal Nation; hold on-going in-person meetings with primary study partner; hire Indigenous doctoral student.

Acronyms. SKC = Salish Kootenai College; IRB = Institutional Review Board; CAT = Community Advisory Team; CEO = Community Engagement and Outreach; MOA = Memorandum of Agreement.

The study team participated in several in-person conversations with key stakeholders across the CSKT Tribal Nation to identify a primary community partner. In particular, Principle 9 resonated with the current study. Indigenous researchers who engage in academic research further benefit a research study by having both western knowledge and the lived experience as a Native American.[10] The first author and another doctoral student from the partnering Tribal Nation are both Native American and share the lived experience of residing in a Tribal Nation. The university and Tribal Nation partnership is partly fostered by supporting Indigenous investigator development.[18] Kovach (2010) describes the importance of researchers to self-identify their standpoint in a study as an Indigenous research methodology given that an investigator's knowledge, training, and experiences help shape the overall study.[19] That is, the Indigenous investigator (Ms. Helen Russette, "HR") holds the perspective as a tribal member that was raised on a Montana reservation. This standpoint has informed the study design, such as creating probes for historical and contextual barriers.

Indigenous CBPR principles were also incorporated through use of the local Salish Kootenai College (SKC) Institutional Review Board (IRB).[10] The SKC IRB maintains primary oversight and approval of the research that emerged from the development work. Careful consideration of adapting the tribal college-approved consent form included providing additional

safeguards to maintain participant confidentiality and providing in-person support from CSKT Early Childhood Services (ECS) Family Advocates to aid in describing the study during the consent process. In addition, CAT members provided review and approval of study materials, including piloting the informed consent. Details about CAT members are provided in the subsequent section.

4. Community Advisory Team

A major component in the development phase was to develop a Community Advisory Team (CAT) composed of community members that are Native American, non-native, tribally enrolled, and non-enrolled. All four CAT members have either professional and/or personal experience in working with the study target population. Research staff met regularly with CAT members, both individually and as a whole group, to review all aspects of the study. CAT members committed to review and provide approval of the following items: 1) research question; 2) study design including tools, presentations, papers, marketing, and recruitment materials; 3) community and stakeholder dissemination plans; and 4) translation of findings back into the community.

CAT members and the CEO Core staff person (acting as a community liaison) identified key stakeholders within the community and attended in-person meetings and presentations with community leaders. Several meetings and presentations occurred across the community with respective leaders and potential partners. With support from CAT members, the research team presented and/or met with the following tribal community leader groups to receive input and approval of the study proposal: Tribal Council, two Culture/Elder Committees, and SKC IRB. Additional community groups with whom the study proposal was presented or with whom it was

discussed included two local hospitals, the local Tribal Health Department, and a tribal home-visiting program.

The intention was to establish a long-term relationship with the CSKT Tribal Nation that is built on trust and respect. Attending any local events, especially when invited, was critical to establish rapport with key stakeholders and community partners. A CAT member invited research staff to attend local community events to help familiarize themselves with CSKT and vice versa. Unanticipated tribal and community knowledge was also gained after spending time at their annual powwow/celebration and tribal health fair.

Results

Results involved developing a: 1) successful research-community partnership; and 2) robust study design including a dissemination plan with efforts to translate study findings back to the community. The development period occurred from August 2017 until July 2019.

1. Partnership development

There were several challenges that occurred during the process of developing a research partnership with a Tribal Nation. Table 2 briefly lists the key challenges and subsequent solutions. Identifying a primary Indigenous community partner who aligned with our study question proved challenging. Other challenges included having leadership turnover and general concern about research. Meetings and presentations were often postponed due to inclement weather and community funerals. For instance, Culture/Elder Committee presentations were held in buildings that host funerals, community events, and research presentations. One study proposal presentation was postponed for three months due to back-to-back funerals. Although the described challenges are not study findings, we speculate these challenges indicate a history

of mistrust between Native Americans and researchers and a high burden of deaths in the community.

Table 2. Research partnership development: Key challenges and solutions

Challenges	**Solutions**
Identifying study community partner aligned with study question.	Establish Community Advisory Team (CAT); Host several meetings in community.
Recruitment: Study population may be indirectly identified by recruitment flyer (see Appendix C).	Include families with children without prenatal substance exposure to avoid indirectly identifying families with a history of substance exposure.
Recruitment: Barriers, such as childcare, loss of wages and transportation may occur for caregivers.	Receive direct support from Family Advocates to recruit participants and provide childcare and transportation to caregivers participating in an interview. Participants also receive monetary compensation for their time.
Compensation: Community partner is not able to enter a sub-contract with the research team.	Establish a Memorandum of Agreement between the research team and community partner to detail compensation for specific activities and resources.
Time to successfully partner with Tribal Nation	Request and receive an additional year of development award funding.

Key solutions were facilitated by hosting in-person meetings in the tribal community and attending local community events when invited by members of CAT members to better understand the community context and needs. Maintaining communication by telephone with the Culture/Elder Committees helped to ensure the study proposal presentation remained on their agenda. Researchers were able to present the study proposal to both Salish and Kootenai elders and incorporate their suggestions into the study design. After several in-person meetings and revisions to the study question and study design, researchers were able to successfully partner with CSKT Early Childhood Services (ECS).

In-person conversations were imperative to develop the ongoing partnership with ECS. During these conversations, the ECS Department Head and research staff discussed broad research goals where both parties identified as an aligned vision and goal for families. ECS is an ideal community study partner as they serve our target population, families with young children

with prenatal substance exposure. They actively promote early caregiver-child engagement opportunities through the HeadStart programs, home-visiting programs, the native language immersion program, and through family-friendly community events. Such programs and events offer family dinners, home visits, cultural activities like powwows/celebrations and traditional beading, and communication of local resources.

Memorandum of Agreement

To formalize the partnership with the primary study partner, we entered into a Memorandum of Agreement (MOA) that is presented in Appendix B. Challenges have occurred regarding legal differences between the tribe and the university legal counsels that required approximately a year for the MOA to receive approval. The MOA is specific and detailed to ensure the study is described in a comprehensive manner with the protection of the study participants at the core. The MOA offers several benefits: access and flexibility for the primary study partner to allot money to their programs and services; a detailed study design that includes agreed upon activities by party; and it acts as an official agreement between the university and the tribe allowing for continuance of the study should there be leadership turnover.

Tribal Ownership of Data. Tribal ownership of the data and study materials is a primary component of the study plan which aids in fostering trust and maintaining a long-term partnership.[20] AIAN CTRP-supported social networking events had also reinforced the importance of data sovereignty. The research team acknowledges and agrees that the study findings ultimately belong to the Tribal Nation, particularly the community partner. Sharing of data is one practice to honor and respect tribal sovereignty. Research staff have outlined data-sharing and data transfer criteria which is detailed in the MOA. Language detailing tribal ownership of the data is included in the "Intellectual Property" section in the MOA and requires

approval from the community partner to determine when and with whom, study findings are disseminated. The approval process outlined in the MOA includes safeguards for the sharing of data with the primary goal being that the tribe has information (e.g., contact information) to access any de-identified data.

2. Robust Study Design

We presented the proposed community-informed study to four tribal leadership groups (Tribal Council, two Culture/Elder Committees, SKC IRB) as part of a formal and informal process to receive approval and ensure opportunities are available to incorporate community knowledge into the design. Table 3 provides details of community leaders and programs, along with subsequent research team activities, and final outcomes. Key stakeholders, such as a Tribal Council person, have personal and/or professional experience in working with the study target population and provided input through in-person meetings. This councilwoman also provided guidance and support of the study topic. Key community leaders included two culture committees composed of elders and the Tribal Council. All suggested additions and revisions were incorporated. For example, we incorporated the newly implemented Native language immersion program as a resilience cultural factor in our semi-structured interview tool for the qualitative study upon the request of the Tribal Council and the Salish Culture Committee during our in-person study proposal presentation. Interest and approval with revisions of the study proposal always occurred as part of in-person conversations and presentations, stressing the importance of face-to-face meetings with the community members.

A review of the literature also helped to refine the study question and study design with review and approval from key community stakeholders, SKC IRB, Culture/Elder Committees, Tribal Council, CAT members, and the primary study partner. Among other populations,

diversity also exists across Native American populations and adapting research strategies to the culture and community contexts is important to support community engagement and adoption of study findings.[15]

Table 3. Community engagement activities and subsequent outcomes.

Community Leaders and Programs	**Activity**	**Outcome**
Two Culture/Elder Committees	Presentation of study proposal	Approved with minor revisions
Tribal Council	Presentation of study proposal	Approved with minor revisions
Councilwoman	Meetings to discuss study proposal and provide updates	Support and guidance
Tribal Health Department	Presentation of study proposal; meeting with department head	Support; Two Community Advisory Team (CAT) members
Tribal-owned home-visiting program	Presentation of study proposal; meeting with department head	None
Local hospitals with innovative programs for substance-abusing pregnant women	Presentation of study proposal; meeting with clinical staff currently serving target population	Support; CAT member; in-progress partnership to recruit participants
Federally funded HeadStart program	Presentation of study proposal; meeting with department head	Support; primary study partner; dedicated staff and space for study activities.

Lastly, the structure and resources of the grant mechanism/funder, the AIAN CTRP, led to several beneficial study outcomes. First, formative conversations involved discussing study tools and to avoid seasonal variability of the amount and type of outdoor activities (e.g., yard play, berry-picking, and hiking) that families engaged in to promote a more robust study design. Second, the AIAN CTRP community liaison was pivotal in aligning the study question with the appropriate Tribal Nation. The liaison also created opportunities for research staff to meet with community gatekeepers to increase study support.

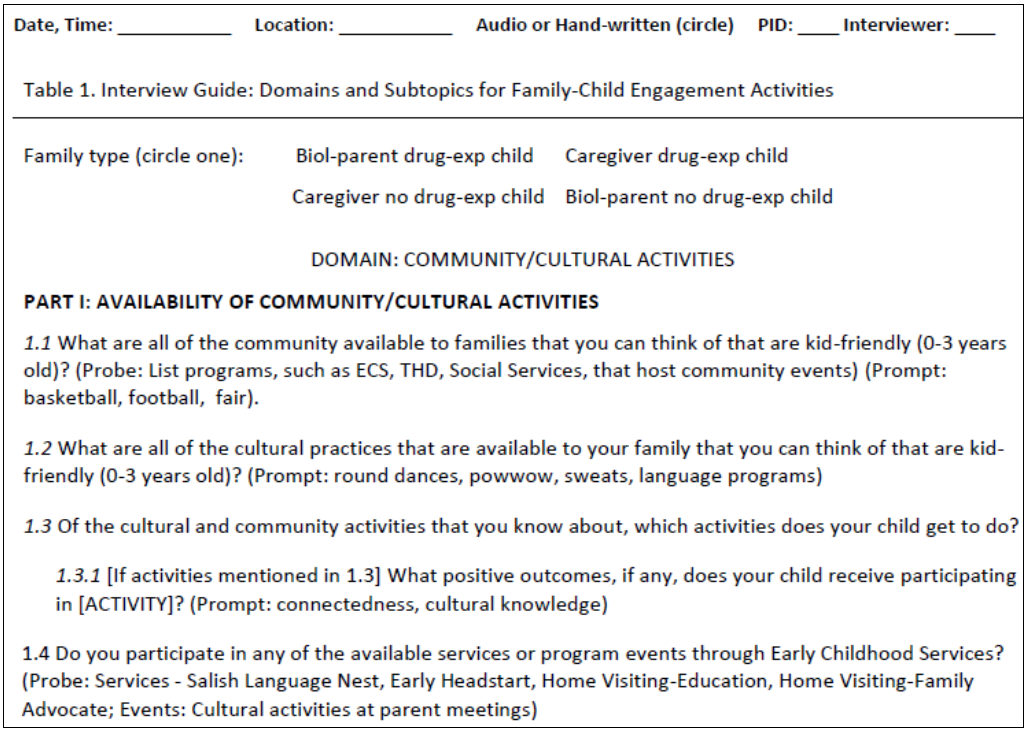
Designing the qualitative study

As part of the CBPR process, study and community partners identified the need for a small-scale qualitative study with the goals of identifying common activities, and barriers, facilitators, and positive child outcomes to activity participation across four domains (cultural, community, outdoors, and home) among families in the CSKT Tribal Nation. Table 4 summarizes the qualitative study and the quantitative future study that highlights study components informed by the community. Community conversations also aligned with study findings that indicate Indigenous pregnant women engaged in substance use posed unique risk factors such as having experienced poverty, unstable housing, low education attainment, child welfare system involvement, sexual abuse, or had either parent attend a residential school, indicating a range of distal to proximal determinants for substance use.[21]

Table 4. Community-informed study components	
Qualitative study	
Target population	*Families with children ages 0-3 residing in CSKT community regardless of prenatal substance exposure and HeadStart participation (N=15).*
Assessment of prenatal exposure to opioids, meth, or other substances	
Subjective	*Caregiver interview question*
Resilience-promoting factors	
Cultural/ traditional	*Items within semi-structured interview tool informed by CAT members, CSKT ECS, Elder Committees and Tribal Council; Qualitative interviews conducted at CSKT by Helen Russette.*
Community	
Outdoors	
Home	
Quantitative study: Beyond dissertation	
Target population	*Families with children ages 1-3 residing in CSKT community regardless of prenatal substance exposure and HeadStart participation (N=30).*
Assessment of prenatal exposure to opioids, meth, or other substances	
Subjective	*Caregiver survey question*
Exposure variable	

Family-child engagement	*Qualitative study findings will inform items comprising the novel Early Family-Child Engagement tool that quantifies family-child engagement; proposed items reviewed and revised by CAT members in March 2020 at the in-person workshop.*
CSKT = Confederated Salish and Kootenai Tribes; CAT = Community Advisory Team; CSKT ECS = Early Childhood Services.	

Community-tailored and culturally sensitive study tools did not exist prompting the need to conduct semi-structured interviews (see snapshot below) for the qualitative study prior to the quantitative study. Both community input and literature informed the development of the qualitative interviews.



Date, Time: _____ **Location:** _____ **Audio or Hand-written (circle)** **PID:** ____ **Interviewer:** ____

Table 1. Interview Guide: Domains and Subtopics for Family-Child Engagement Activities

Family type (circle one): Biol-parent drug-exp child Caregiver drug-exp child
Caregiver no drug-exp child Biol-parent no drug-exp child

DOMAIN: COMMUNITY/CULTURAL ACTIVITIES

PART I: AVAILABILITY OF COMMUNITY/CULTURAL ACTIVITIES

1.1 What are all of the community available to families that you can think of that are kid-friendly (0-3 years old)? (Probe: List programs, such as ECS, THD, Social Services, that host community events) (Prompt: basketball, football, fair).

1.2 What are all of the cultural practices that are available to your family that you can think of that are kid-friendly (0-3 years old)? (Prompt: round dances, powwow, sweats, language programs)

1.3 Of the cultural and community activities that you know about, which activities does your child get to do?

1.3.1 [If activities mentioned in 1.3] What positive outcomes, if any, does your child receive participating in [ACTIVITY]? (Prompt: connectedness, cultural knowledge)

1.4 Do you participate in any of the available services or program events through Early Childhood Services? (Probe: Services - Salish Language Nest, Early Headstart, Home Visiting-Education, Home Visiting-Family Advocate; Events: Cultural activities at parent meetings)

The interviews were designed to inform the future quantitative study specific to common family-child engagement activities that occurred within the target population and to inform the CSKT ECS community partner of potential barriers and facilitators that impact participation in program-sponsored activities.

Study Population Considerations

Substance use during pregnancy is a sensitive topic and required additional safeguards (e.g., see "Title 42 Code of Federal Regulations Part 2") to protect participant confidentiality. That is, patients with a substance use disorder (SUD) are a protected class with extra regulations under the Health Insurance Portability and Accountability Act (HIPAA) to protect disclosure of individuals diagnosed with SUD. Expanding our target population to also include children without prenatal substance exposure removed the possible indirect identification of participants who have children with prenatal substance exposure. Several meetings with key partners led to this decision given that the CSKT Tribal Nation is a heavily interconnected community. Further discussion with community members also led to inclusion of families that are not Native American or tribal members but reside in the Tribal Nation. This decision was based on the diversity within this Tribal Nation, where one-third of the residents are enrolled tribal members.

Shaping the Informed Consent Process

The informed consent process was informed by a literature review, multiple meetings and presentations with the primary study partner, CAT members and the SKC IRB and is presented in Appendix A. As part of this process, Early HeadStart Family Advocates and research staff would receive training in administering informed consent and offering additional verbal description if participants requested clarification of what would be asked of them. The informed consent process incorporated both oral and written communication of the study to participants and included contact information for both research investigators should the participants have any questions. Family Advocates have long-standing relationships with the community and the Early HeadStart family participants, providing a sense of trust.

Dissemination Plan

CBPR is the "gold standard" for Indigenous research as it encompasses equal partnership between tribal community and researcher where parties both co-learn and ultimately both benefit from the study findings.[22] Two primary constructs of CBPR are the returning of research findings to the community partner and determining how findings will be disseminated and translated.[22] A dissemination plan was developed in collaboration with CAT members and community partners. CAT members and ECS staff, both of whom were invited to be co-authors on publications, have agreed to review, provide approval, and support dissemination of study findings (e.g., study updates, study proposals). Study results will be presented in an understandable, relevant, and accessible way to community members, ECS staff and families, and community leadership groups (e.g., Tribal Council, Culture/Elder Committees).

Specific language was added to the MOA to formalize the dissemination process. The dissemination plan outlines that ECS may leverage study findings to apply for tribal- or community-level grant funding, and ECS will utilize study findings to inform their current services and programs. This utilization of the study findings is one part of an effort to establish trust between the community and the research team. Both parties agree the de-identified data ultimately belongs to the community and that community directly benefits by applying for additional resources and receiving information regarding their programs and services. Approval will continue to be sought from the primary study partner, the AIAN CTRP community liaison, key community leaders, and CAT members concerning the publication and presentation of study findings.

Discussion

The development phase described in this chapter resulted in promising practices and lessons learned on partnering with a Tribal Nation to design a study on a sensitive subject with a

highly stigmatized population. Table 5 summarizes the development study objectives, significance and innovation, study design, approach, and outcome of this work. Community-driven, community-based participatory research (CBPR) and strengths-based approaches informed and shaped the overall research design which showcased the innovative programs available in the CSKT Tribal Nation. Consulting key community stakeholders to determine alignment of the study design is one example of acknowledging historical experience by providing an opportunity for an Indigenous community to place restrictions and oversight on research before it occurs.[10] Indigenous and non-Indigenous stakeholders that serve Indigenous populations within the Tribal Nation hold knowledge and experience with the study topic. They were pivotal in designing the qualitative study that would inform the future quantitative study, and garnering buy-in from community leaders. Stakeholder feedback helped to ensure study questions were relevant and of interest and importance to CSKT.

Table 5. Methodological study components and summary

Objectives	Significance and Innovation	Study design	Approach	Outcome
1) Successfully partner with a Tribal Nation. 2) Design a mixed-methods study on a sensitive topic with a stigmatized population.	AIAN experience high rates of substance use disorder despite concerted efforts for intervention and prevention. CBPR is a recommended approach with AIANs and may be especially useful for research on a sensitive topic with a highly stigmatized population.	Methodological	CBPR, strengths-based, community-driven	1) Partnered with CSKT community, specifically with CSKT ECS. 2) Developed study design

Notes. AIAN = American Indian/Alaska Native; CBPR = community-based participatory research; CSKT = Confederated Salish and Kootenai Tribes.

Becoming familiarized with the community required planning for extended timelines, which is a recommended principle for engaging in CBPR methods with Indigenous communities.[10] The AIAN CTRP funding mechanism supported the research team to receive development awards that spanned two years. This was instrumental in providing the research

team with ample time to visit the community and successfully partner on a research study with the CSKT Tribal Nation.

To honor tribal sovereignty, the authors acknowledge that study findings ultimately belong to the tribal community.[10,15,20,23,24] To safeguard participant confidentiality, both parties understood that the primary study partner would have full access to all de-identified data. A semi-structured interview tool was developed to also collect relevant program data. This data will be made available by translating findings that the primary study partner could leverage.

The contribution of Native American researchers and Tribal Nation stakeholders have shaped the selection of questions for the semi-structured interviews. Several concerns were raised by key community stakeholders about the common and problematic "helicopter researcher" experience that has created a history of mistrust between tribal communities and researchers.[10,15,20,23,24] As part of the study proposal process, the research team was intentional about continuing to engage in ongoing and future research.

The aligned goals between CSKT, ECS and the research team created a strong investment from all parties to identify what factors may help to improve the quality of life for families residing in Tribal Nations. Research staff met with tribal stakeholders across the CSKT community to identify community needs and interest in engaging in research. Outcomes from this development phase led the research staff to design a mixed-methods study with the first study being a qualitative study. The qualitative study is intended to identify common positive family-child engagement activities across four settings (culture, community, outdoor, home) among primary caregivers to young children with and without prenatal substance exposure that reside in the Tribal Nation. This study is described in the subsequent chapter and is currently in review for publication at an academic journal.

Conclusion

Successful collaboration with the CSKT was made possible because our research aligned with their community goals. Researchers were able to allot meaningful time to develop this partnership through ongoing support from AIAN CTRP. Applying CBPR, strengths-based, and community-driven approaches we were able to design a study that incorporated cultural-sensitive and community-relevant measures with the goal of designing an effective and rigorous study to better serve the Tribal Nation on addressing substance misuse.

Next steps are to 1) continue carrying out study activities as part of a mixed-methods epidemiological study that will measure early family-child engagement and greenspace exposure against social-emotional development among children with and without prenatal substance exposure; and 2) continue collaboration with the CSKT partner to identify future research that would produce impactful interventions in the context of families with a history of substance misuse. The subsequent chapter summarizes the qualitative study, as part of the mixed-methods study, that was completed July 2019.

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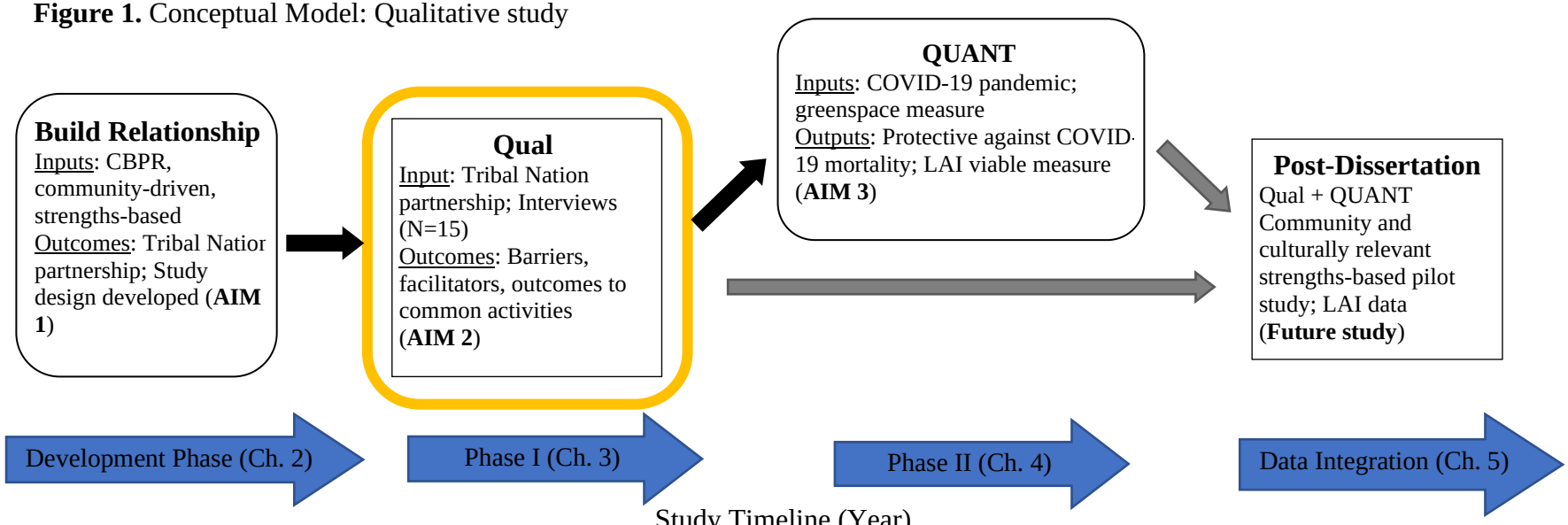
CHAPTER 3

QUALITATIVE STUDY 2: Identifying family-child activities among children with prenatal substance exposure in a Tribal Nation: Caregiver perspectives on barriers, facilitators and positive outcomes.

Publication Status:

A modified version of this manuscript is in review at PLoS ONE. This original manuscript was approved by the Confederated Salish and Kootenai Tribes (CSKT) Tribal Council and CSKT Early Childhood Services. In addition, CSKT Tribal Council approved the use of 'CSKT' in the manuscript.

Figure 1. Conceptual Model: Qualitative study



Acronyms: CBPR = Community-based participatory research; LAI = Leaf Area Index; Qual = small qualitative study; QUANT = large quantitative study.

Notes. Overall study uses an explanatory sequential mixed methods design. Data collection occurs in two phases: 1) qualitative interviews and 2) passive sampling of greenspace exposure via LAI deciles to inform future study. Black arrows = paths that comprise the dissertation. Gray arrows = paths that comprise the future study.

Abstract

Background*:* Children with prenatal substance use exposure (PSE) are at heightened risk of maladaptive functioning, such as internalizing (e.g., anxiety) and externalizing (e.g., angry outbursts) behaviors, if early intervention does not occur. Identifying resilience-promoting factors is needed to inform future interventions aimed at improving long-term development. Objectives*:* 1) Identify barriers, facilitators and positive child outcomes to family-child engagement activities that families to children with and without PSE experience across the community, culture, outdoors, and home settings. 2) Identify common activities to inform a continuous study tool that will measure cultural-sensitive and community-relevant activities as potential resilience factors in a future study. Methods*:* Biological parents and caregivers to children, ages 0-3 years old with or without prenatal drug exposure (N = 15) were recruited from the Confederated Salish and Kootenai Tribes Nation to participate in an in-person semi-structured interview. Data analysis consisted of research yarning and directed content analysis to collect unique stories and to identify common activities, barriers, supports and positive outcomes among families, respectively. Research yarning is an Indigenous research method consisting of an informal, relational conversation occurring within an Indigenous context. Directed content analysis was applied to validate activities identified by the community stakeholders and literature, and to identify new common activities. Results*:* Attending multiple powwows/celebrations, swimming, and reading were the most mentioned activities. Families to children with PSE mentioned more often engaging in cultural activities compared to their counterparts to children without PSE. Cost and transportation were common barriers to activity participation. The most common support mechanism provided was having family or friends present to participate in activities. Cultural knowledge and bonding were common positive

outcomes for a child engaging in activities. A collection of stories identified both familial barriers to traditional ways of knowing and participation in community, and community-implemented efforts to bridge that gap among families with a history of drug and alcohol use. *Conclusions:* This study identifies activities, and barriers and facilitators to activity participation that may provide a buffer against the harmful impacts of PSE among families that reside in Indigenous communities.

Keywords: familial barriers, Native Americans, resiliency, Indigenous Research Methods,

Introduction

Opioid and poly-substance use among pregnant women is an increasing epidemic largely attributed to the overprescribing of opioids to manage pain and challenges to non-opioid pain management.[1-3] Native American (Native) pregnant women are nearly six times more likely to have opioid use disorder compared to their non-Hispanic black counterparts.[4] Historical and contemporary traumas are largely attributed to substance misuse among Native populations. Indigenous clinician and researcher, Maria Yellow Horse Brave Heart defines historical trauma as the, "…cumulative emotional and psychological wounding, over the lifespan and across generations, emanating from massive group trauma experiences." (P. 7)[5] For example, the loss of traditional transference of knowledge and practice can be partly attributed to forced attendance in boarding schools has led to significant detrimental outcomes across generations of tribal people such as using drugs or alcohol as a coping mechanism.[6] Of major concern is the impact of prenatal substance exposure on fetal development.

Prenatal methamphetamine and opioid exposure is associated with neurobehavioral deficits in long-term learning and memory and externalizing (e.g., aggression, hyperactivity,

disruptive) and internalizing (e.g., anxious, withdrawn, depressed) behaviors.[7-9] These can result in complex health care needs for the child and associated economic burdens placed on families and communities.[10-12] Although these statistics and outcomes are worrisome, it is important also to share that Indigenous communities are a place of both resilience to historical and contemporary trauma and resistance to colonization through community and cultural revitalization. For example, a large-scale randomized-control trial among pregnant Native American teenagers participating in a federally-endorsed, culturally congruent home-visiting intervention called Family Spirit was developed and implemented among participating tribal communities.[13] Authors found that children born to mothers with a history of alcohol, marijuana, or illicit substances demonstrated greater improvements in emotional and behavioral outcomes after receiving the Family Spirit home-visiting intervention compared to their counterparts that did not receive the intervention.[14] It noteworthy that Family Spirit is the only evidence-based home visiting program developed, and not adapted, for pregnant and parenting Native American families.[15]

The goal of this project was to identify positive family-child engagement activities and learn of potential barriers, facilitators and positive child outcomes among families that reside in the Confederated Salish and Kootenai Tribes (CSKT) Tribal Nation. This CSKT Tribal Nation has established community-wide supports to promote family and community connectedness. Our two study questions are as follows: 1) What are the common family-child engagement activities that families with young children with and without prenatal drug exposure participate in across four domains (cultural, community, outdoors, home)? 2) What common positive child outcomes, barriers, and facilitators to these activities exist among this population?

Methods

In the previous chapter (chapter 2), we described our approach to developing 1) a collaborative research partnership with CSKT Early Childhood Services (ECS) and 2) the qualitative study described here. The Salish Kootenai Institutional Review Board provided review and approval of our study, and all participants provided informed consent (see Appendix A). In addition, the Culture/Elder Committees and Tribal Council within the Tribal Nation approved our study.

Sampling and recruitment

We conducted an *a priori* sampling approach using a purposive sampling method. This method is used strategically to identify participants who would provide rich information for qualitative inquiry.[16] Purposive sampling provides evidence that twelve qualitative interviews can reach saturation.[17] ECS Family Advocates supported a research staff person (Ms. Helen Russette, "HR") in recruiting primary caregivers to children, ages 0 - 3 years, with and without prenatal drug exposure. Participants to children without prenatal substance exposure were included based on community concern of indirectly identifying children with substance misuse. Participants were also organized into "family type" to determine if salient differences were present in type of activities, and barriers, facilitators and positive child outcomes to activities. Family type is organized status of biological parent or non-biological parent to a children with or without prenatal substance exposure. Table 1 provides number of participants recruited by family type. Recruitment communications consisted of disseminating a flyer, describing the study and eligibility criteria, on several platforms (e.g., word-of-mouth by Family Advocates, email listserv to tribal employees, ECS social media, ECS office). Family Advocates have existing relationships with the study population through the ECS Home-Visiting program. Overall,

Family Advocates supported recruitment and participants by offering transportation to and from interview sites, offering childcare at the interview site, and being present as an emotional support. With their support, we recruited and conducted interviews within a three-week period. Participants also received $50 cash reimbursement for their time.

We included participants who were at least 18 years of age, had primary custody of their child, and whose child was between 0 – 3 years of age at the time of study. We excluded individuals who self-reported having drugs in the home given the potential risk if an interview needed to occur in the home.

Procedure and Study population

The qualitative study described in this chapter was conducted from January 2019 to July 2019 in partnership with ECS and guidance from the established CAT. All ECS HeadStart sites across the Tribal Nation provided space to conduct in-person interviews and support participation among individuals residing in rural or isolated settings. Participants contacted one research staff person by phone call or text for recruitment eligibility. Participants provided their names, contact information, child's age, and location. All participants consented to audio-recording during their interview and being contacted for future studies. Family Advocates and research staff received training in administering informed consent, offering further verbal descriptions, and soliciting participants' requests to clarify interview questions. The informed consent process incorporated an oral and written description of the study to participants. Research staff also provided contact information to participants should they have any questions following the interview.

Each participant was assigned a unique participant ID prior to their interview. All identifying information was separated from the interviews and stored in a secure password-

protected, HIPAA-compliant web-based application. Post-interview, a research staff person (HR) transcribed all interviews. NVivo 12 software was used to store data and conduct analysis.[18]

Study instrument

Study authors, Community Advisory Team members, and community partners contributed to and approved the final interview tool. The 34-item semi-structured interview tool consisted of open-ended questions organized by domains (see Appendix D). These domains consisted of cultural, community, outdoors, and home settings where the child would engage in activities with their caregiver or another family member. Categories within each domain consisted of available activities, barriers that prevent activities, and facilitators to activities. Select items within categories are activities that an individual child participates in, favorite activities, specific barriers and facilitators to participate in activities, and positive outcomes for children engaging in activities.

Demographic and family characteristics were collected and consisted of participant and child age, race, child prenatal drug exposure status, participant relationship to child, number of family members spending time with child, number of children in the home, and family type. Community stakeholders discussed with researchers common traumatic events that result in a children being removed from their biological parents' homes regardless of prenatal substance status. Therefore, we created family types. The research instrument defined and delineated family type into the following four categories: 1) biological parent to a child with prenatal drug exposure; 2) biological parent to a child without prenatal drug exposure; 3) Caregiver to a child with prenatal drug exposure; 4) Caregiver to a child without prenatal drug exposure.

Study objectives for the information collected from the semi-structured interviews were to inform:

1. Development of a quantitative tool (i.e., Early Family-Child Engagement survey) to be used in a future study (i.e., beyond my dissertation) that will evaluate the influence of early child-caregiver engagement on behavioral development in early childhood.
2. Early Childhood Services of potential unmet needs in the population they serve. Completing this objective was meant to provide a direct benefit to the study team's community partner.

Data analyses

The semi-structured interview tool was informed by a review of the literature on common activities among young children, community conversations of existing activities, barriers, facilitators and positive outcomes, and piloting the interview tool with a Community Advisory Team member that has a child with prenatal substance exposure and resides and works in the CSKT Tribal Nation. These sources provided the initial coding scheme that would guide the directed content analysis.[19] Specifically, the qualitative directed content analysis approach was applied to validate and identify new common activities, positive outcomes for child participating in activities, barriers to activities, and facilitators to activities.[19,20]

Research yarning is an Indigenous research methodology that occurs as an informal, relational conversation occurring within an Indigenous context. [21,22] We applied research yarning to highlight a collection of stories that families with a history of alcohol and drug use experience in relation to their tribal identity and practice of traditional activities. Kovach (2010) describes research yarning as a conversational method similar to narrative inquiry but having distinctive characteristics.[22] Such characteristics are: 1) linking tribal knowledge within an Indigenous paradigm, which is the tribal community's worldview and how it influences particular methods (e.g., Indigenous, CBPR); 2) relational in terms of interviewer and interviewee; 3) purposeful by

often involving a decolonizing aim that brings to surface the Indigenous-settler relationship as a source of social inequities and prioritization of Indigenous knowledge; 4) informal and flexible; 5) protocol is driven by tribal knowledge or place; for example, gifting sweetgrass to acknowledge the relationship and show respect; 6) collaborative and dialogic; and, 7) reflexive (P. 43).[22] For our purposes, informal conversations occurred that were dialogic, which is an Indigenous relational approach to hold space for participants to tell their story and thereby impart knowledge.[22]

The semi-structured data collection technique chosen for this study derives individual-level experiences and opinions rather than cultural-level information, [23] in which the interviewer (HR) can deviate from the questions to probe for more information when participants mentioned familial barriers to participating in their traditions and community. Analysis of data occurred by family type to improve specificity of considerable potential differences between the groups due to the inherent stigma that substance-abusing mothers and fathers experience when mother is pregnant. [24]

One research staff person (HR) constructed the coding scheme and reviewed it by an additional research team member (JB) that resides within the Tribal Nation. Inter-rater reliability assessment came from comparisons by two raters (HR, JB) of classified responses to derive the overall agreement between coders using Cohen's kappa.[25] Cohen's kappa is a test statistic that takes into account the amount of agreement between coders that could be expected to occur by chance. After initial coding was completed, the second coder (JB) coded thirty percent of all interviews. Next, queries within NVivo 12 performed kappa and agreement values.[18] The overall agreement between coders was 87.8% (11.8/15), with Cohen's kappa being significantly higher than expected by chance and representing excellent agreement.

Dissemination plan

Dissemination efforts thus far have included either a presentation of study findings or sharing a digital story of study findings to ECS, Culture/Elder Committees, families participating in ECS programs, and the Tribal Council. The digital story approach also provided synchronous audio and closed-captioning to improve accessibility for elders and people with disability. Digital storytelling is one way of translating study findings back to the community in an effort to fulfill our relational obligation of sharing the findings with the community that is inclusive and tailored. [26]

Results

Fifteen primary caregivers were recruited from the CSKT community. All had completed in-person interviews that ranged from 45 minutes to two hours in length at various HeadStart site locations within the Tribal Nation. Demographic characteristics for all participants are provided in Table 1.

Table 1. Demographic and family characteristics of participants in one Tribal Nation, 2019 (*n* = 15).

Demographics	Freq. (%)
Age, participants:	
20-24 years old	1 (6.7)
25-30 years old	10 (66.7)
31-40 years old	3 (20.0)
41 and over	1 (6.7)
Race, participants:	
Native American	14 (93.3)
Caucasian	1 (6.7)
Age, child:	
< 6 months old	3 (20)
6 – 12 months old	1 (6.7)
13 months – 2 years old	7 (46.7)
3 years old	4 (26.7)
Race, child:	
Native American	15 (100)
Family characteristics	
Family type:	
Biological parents to a child with prenatal drug exposure	5 (33.3)

Biological parents to a child with no prenatal drug exposure	8 (53.3)
Caregiver to a child with prenatal drug exposure	1 (6.7)
Caregiver to a child with no prenatal drug exposure	1 (6.7)
Family members spending time with caregivers' children in a typical week:	
1-5	4 (26.7)
6-10	7 (46.7)
11-20	3 (20)
over 21	1 (6.7)
Children (cousins, siblings) residing in the primary home of the child:	
0	3 (20)
1-2	5 (33.3)
3-5	5 (33.3)
6 or more	2 (13.3)

Factors related to family-child activities

Participants shared several activities that they, family, and/or friends do with their child across several settings. Results are summarized with representative quotes and organized by domains in the subsequent section.

Cultural and Community

Activities. Participants mentioned attending powwows/celebrations with their child, which are often annual events consisting of traditional dance and drumming and that their child participated in their local home-visiting program. Biological parents to a child with prenatal drug exposure also mentioned participating in and attending cultural crafts and games, traditional events in sacred places, annual cultural camps, and sports-related events. Biological parents to a child with no drug exposure also mentioned participating in their local Native language immersion program at ECS, and other community-sponsored events. The caregiver to a child with prenatal drug exposure also mentioned attending ECS-sponsored events.

They do a trip to Kootenai Falls and that's for also cultural [purposes]…language [camp], he's a really good talker, he's fluent. [What's he fluent in?]: Kootenai. My mom always teaches him words.
- Biological parent to child with prenatal drug exposure.

Positive outcomes. Physical activity, connectedness, cultural knowledge, and enjoying the activity were shared as positive outcomes to participating in cultural and community events.

She really loved the powwow, so we brought her to the other ones and when we put her in the car seat to get ready to go home she would cry… I feel like it kind of soothed her. She liked the sounds, like the drumming. And the stick game, also. Also, they get to see family members.
[Kootenai Falls Ceremony]: He gets to learn how sacred the Kootenai Falls is to the people and the songs and the water…He'll be like, "Yea, I get to know where our sacred lands are, and ancestors."
[Cultural language camp]: He is speaking Kootenai. They'll teach him how to do canoes out of bark. They make drumsticks. They did do "How to make drum."
[Elders Week]: He gets to learn about his elders and how to treat them. Learn about how important they are. How to respect them.
- Biological parents to child with prenatal drug exposure.

Barriers. Limited or no communication of events, cost, and lack of transportation were mentioned as common barriers to participating in cultural and community events. Biological parents to a child without prenatal drug exposure also mentioned family not having a cultural background, time, and conflicting schedule for events.

I find out about it right as it's happening so it's kind of like "Well, I can't go now because it's already happening."
- Biological parents to child with prenatal drug exposure

You have to have the money to just put in an order. Who has $500 dollars to put in an order? It's for the outfit, not even including the beadwork. Which, I can bead.
-Caregiver to child without prenatal drug exposure

Facilitators. Transportation, childcare or kid-friendly events, time of event, location of event, no-cost event, feeling accepted at event, family or friend presence, and community resources were common supports to participating in community and cultural events.

I feel accepted at the People's Center [cultural community center] when they have classes to teach you how to bead.
- Biological parent to child with prenatal drug exposure

For the HeadStart events, between the Family Advocates and whoever else they have, they kind of you know if families need transportation to and from activities, they try to do as much as they can to get them there to and from.
I like family around or at least a friend. If I didn't, I would just stay back and not really talk to anybody.
- Biological parents to child without prenatal drug exposure

We had a parent this year that made her a dress...for powwow.
-Caregiver to child with prenatal drug exposure

Outdoor activities

Activities. Participants mentioned mostly walking or running, swimming, going to the park, and berry-picking as common favorite outdoor activities they or others do with their child.

Hiking. We go over to Trout Creek a lot.
-Caregiver to child with prenatal drug exposure

Walking, hiking. Being able to observe nature. I think being outside, in general, just calms her down.
- Biological parent to child without prenatal drug exposure

Positive outcomes. Gaining knowledge, bonding, happy child, soothing, physical activity, and exploring energetic were common outcomes from participation in outdoor activities.

He gets more energetic in the water. He gets excited when he sees any kind of water.
- Biological parent to child without prenatal drug exposure

He learns how to play with other kids at the park.
He'll try to head out all quick to the park and once he gets there, he'll be a happy boy.
- Biological parents to child with prenatal drug exposure

Barriers. Safety concerns, location, community resources, cost, negative attitudes, and time as common barriers to outdoor activities.

Swimming, if it's in a closed environment like the pool here, it cost a lot of money to go, so I don't feel it's something that we can do.
- Biological parent to child with prenatal drug exposure

They caught one [a mountain lion] right across the highway in the park and that's right in town.
- Biological parent to child without prenatal drug exposure

I don't think people understand probably what she's been through and why she is the way she is. She will literally go up to any stranger and probably get in the car and go home with them.
-Caregiver to child with prenatal drug exposure

Facilitators. Family or friend presence, transportation, safety of activity, and community resources were common supports to doing outdoor activities.

There's the Buddha Gardens…they can walk around there because they're safe.
- Biological parent to child without prenatal drug exposure

They like to spend time at grandma's house…she has a closed-in backyard. There's a playground closer to her house than there is to mine.
- Biological parent to child with prenatal drug exposure

It's always nice to bring friends for the kids, like cousins.
-Caregiver to child without prenatal drug exposure

Home activities

Activities. Participants mentioned mostly reading, having meals together, singing, cuddling, and play time as common favorite home activities they or other family do with their children.

We'll sing songs to him, but there's the songs from our Jump Dances and sweat houses. Like him learning those songs.
Reading. I want to do that as much as I can and if other family members would do that [reading] with him that would be awesome.
- Biological parent to child without prenatal drug exposure

My mom will sing to her like Native songs and stuff.
Dinner also with family members. Like, with all of my family, like cousins, other aunts.
- Biological parents to child with prenatal drug exposure

Everything we do is together. We do a lot of reading, a lot of coloring, anything that can stimulate them.
-Caregiver to child with prenatal drug exposure

Positive outcomes. Participants mentioned bonding, being happy, knowledge, soothing, laughing, healthy development, and connectedness as common positive outcomes to favorite home activities.

The interaction because some babies don't get it and she gets it. She understands that we're interacting with her so that comes really fast for her. A healthy family bond is a good outcome [of the interaction].
Ever since he was little, my brother would sing his powwow music because he was a drummer and singer. So, he'd sing to him when he was little and he would instantly calm down and soothe him. Now, that's him trying to sing to his little brother and cousin.
- Biological parents to child with prenatal drug exposure

Support, trust, understanding, love, communication, feeling like he's part of everything, so being included.
How he can get used to our voices [when reading]. It's their knowledge going and their brain going…He'll sit there and have his eyes wide open, and he'll smile on and off and he'll get tired, too.
- Biological parents to child without prenatal drug exposure

She bonds through it. She laughs with the reading.
She's learning how to share through playtime. She's learning how to think of others' feelings…she's getting a sense of family that she really hasn't had.
-Caregiver to child without prenatal drug exposure

Barriers. Child being fussy, limited time, cost to purchase resources, and home-specific barriers were common barriers to engaging in home activities.

My house is not big enough, my house is not clean enough. Time is a huge thing. Running out of books to read. A big barrier is temperature. So, if it's too hot we do nothing. If it's too cold, all we do is cuddle.
Having that family member that don't like to be involved.
- Biological parent to child with prenatal drug exposure

Facilitators. Income, community resources, having materials, and family or friend support were common supports to engage in home activities.

With my mom or brother helping me with any activities for us to do is a big one. Or the materials like more books, games… Head Start or Early Childhood Services would help me get these materials that I need. I'm the only one that is supporting my kids. My mom helps when she can.
- Biological parent to child without prenatal drug exposure

I have older children as well so that is a support for younger ones to be able to do activities with them. Just having that family member present and maybe able to watch the little ones while we are able to do something with her age.
-Caregiver to child with prenatal drug exposure

Early Childhood, they always send out things that you can do with your kid…they also send out different kinds of snacks that you can make together. The WIC office does the same thing, like the food prep for babies, certain ages.
- Biological parent to child with prenatal drug exposure

Community bridge to traditional practices and identity

Familial barriers. Participants that with and without a family history of substance use described a lack of familial exposure as an inherent barrier to knowing and practicing their cultural traditions and raised concerns of not being able to pass on such knowledge to their children. The interviewer (HR) was aware of such barriers in her tribal community and probed participants to share more when familial barriers were mentioned.

It's all about your last name. Like if your family is putting on a sweat, it's usually only that certain family. My family has never really participated in any of that so it's hard to find someone to help me get in, because you got to know someone to get help with sweats. I have never danced before and I didn't even know where to start. Me and my daughter want to start dancing and I'm like, "I've never danced. I don't even know if any of our families danced." Kind of sucks. I don't have anyone to reach out to who will sit down and teach me. My daughter is like, "Why don't you just ask someone?" I'm like, "Who am I going to ask?" Because it's kind of awkward if you don't know anybody. Because it's usually passed down through your family and like, "This is your family tradition, and this is the style that your grandma used to do." So, when you don't have that you don't want to ask someone else to pass their family tradition to you unless you're offered it from them, so it's hard. I was telling my aunty, "Man, I wish we grew up dancing." She's like, "Yea, it sucks that our family grew up drinking and doing drugs." It's nice, because that's not the thing anymore. The kids nowadays, like my age, want to restore traditions and get rid of the alcohol and the drugs. Now, that we're trying to better this generation, it's like, "Now, where do I go? How do I better this when all my family are drunks and drug addicts?"

-Caregiver to a child without prenatal drug exposure

Probably because she is a foster child. If she was in a biological family…I just think that when they're foster children they are a little bit lost. They're a part of our family, but they lost their family and some of that culture identity of just who they are goes away. I think they're ignored. They know they're not biologically my children, but they don't know their biological parents always. I do think there is just a disconnect there.
-Caregiver to a child with prenatal drug exposure

Community bridge. Although familial barriers to traditional practices and identity were mentioned, participants also mentioned community supports that act as a bridge between them and traditional identity and practice. The Salish language immersion program offered in early HeadStart is just one example that acts as a facilitator for cultural and traditional knowledge and practice.

They went and dug bitterroots with HeadStart for the first time this year and that meant a lot to them, but that was the first time we've ever did that. I wish there were more things like that. We go to the HeadStart Powwow. I know I can bring all of the kids. The teachers help me. They'll go out and dance with the kids. They will hold the baby if I need them to. It's actually the highlight of our year the HeadStart Powwow. They love it.
-Caregiver to a child with prenatal drug exposure

[Salish Language Nest]: He gets things that I've never got as a kid. So, he gets like introduction to the language, which will probably make it easier on him later in life to learn it. Cultural knowledge, as well because they'll [Home visitors] let me know of any events that will happen. I do feel comfortable talking with them about everything and coming up to my house. At first, I would meet them downtown, but after getting to know them, I let them come up to the house.
-Biological parents to a child without prenatal drug exposure

Discussion

Our study aimed to identify common positive family-child engagement activities and what barriers, facilitators and positive outcomes to those activities exist particularly among children with prenatal substance exposure. Table 2 summarizes the objectives, significance,

innovation, study design, population, study tool and results of the qualitative study. We achieved the study objectives and were able to identify several positive family-child engagement activities, as well as barriers, facilitators and positive child outcomes that families and children experienced.

All participants enjoyed attending and participating in local and nearby powwows/celebrations citing several positive outcomes for their child, like bonding, exercise, and connectedness to the culture and their family. Biological parents to a child with prenatal substance exposure mentioned participating in more cultural activities (e.g., powwows, crafts and games, camps, native language program), and some outdoor and community activities (e.g., Farmer's market, frequenting the park, berry-picking) compared to their counterparts to a child without prenatal substance exposure. They also mentioned positive outcomes more often for cultural activities (e.g., cultural knowledge, connectedness) than both outdoor activities (e.g., knowledge, bonding) and home activities (e.g., soothing, knowledge, bonding) compared to their counterparts to a child without prenatal substance exposure. In addition, many traditional activities and practices shared by participants were land-based. For example, one traditional event involves children attending a camp within the CSKT Tribal Nation where they learn and practice Salish and Kootenai traditional ways of life with their elders. This is an example of Indigenous land-based education and is gaining traction in Indigenous research circles.

Elliot-Groves et al (2020) discusses Indigenous survivability from colonization to a global pandemic through traditional knowledge systems that are derived from the land.[27] Several practices proposed by Elliot-Groves et al (2020) overlap with our study findings.

Table 2. Qualitative study components and summary.

Objectives	Significance/Innovation	Study design	Population	Study tool	Results
1) Identify barriers, facilitators and positive outcomes to potentially resilience-promoting family-child engagement activities. 2) Identify common activities to inform a study that measures family-child engagement and behavioral development among young children.	Children with PSE are at high risk of behavioral dysfunction. Identifying resilience factors against behavioral dysfunction among children with PSE may shed light on impactful community-level resources.	Semi-structured interviews	Primary caregivers to children ages 0-3 with and without PSE that live in CSKT community (N = 15)	34-item interview comprised of open-ended questions organized by domains	1) Multiple powwows/celebrations, swimming, and reading were most mentioned activities across all family types 2) Caregivers to children with PSE mentioned more cultural activity engagement compared to counterparts to children without PSE. 3) Cost and transportation were common barriers activity participation across all family types. 4) Family and friend presence was a common facilitator of activity participation across family types. 5) Knowledge and bonding were common child positive outcomes from activity participation. 6) Community resources provided a bridge between families with a history of substance misuse and traditional identity and practice.

Notes. PSE = prenatal substance exposure; CSKT = Confederated Salish and Kootenai Tribes.

Relevant practices that cultivate health are physical (e.g., walking, running, swimming, connection to mountains, land, water, plants and animals, hunting, gathering, growing, and visiting/connecting to outdoors), intellectual (e.g., reading books, participation in social or civic life, learning ancestral language and Indigenous survival techniques, and playing board games), emotional (e.g., visiting, singing, dancing, drumming, storytelling), and spiritual (e.g., praying, smudging, reconnecting self and children to land, plants and animals, and ancestral relations, retracing steps of our ancestors, and reclaiming Indigeneity) activities.[27] (P. 164). Given the relationality between Indigenous communities and land, there may be the possibility that Native populations residing in Tribal Nations may place more significance and spend more time outdoors compared to other populations. The CSKT Tribal Nation is a heavily forested area and houses a large lake providing ample opportunity for children and families to gain multiple benefits from the "Great Outdoors." However, several barriers to activities were mentioned by participants that could be addressed by facilitators that they had shared as part of community planning.

Familial barriers to learning and participating in cultural and traditional practices were evident and participants indicated interest to learn their traditional practices. A potential solution to overcome the familial barriers to traditional identity and practice was identified through research yarning. That is, the community, through community-level programming acts as a bridge to connect families and children to traditional ways of knowing and to their community. Participants, particularly among families with a history of alcohol and drug use mentioned family advocates and familial or friend presence were facilitators to being able to learn and participate in their culture and community with their children.

Early childhood intervention is critical to reduce symptom exacerbation and attenuate or prevent developmental dysfunction.[28] Interventions that incorporate early and continued family-child engagement promote self-regulation, academics, reduced internalizing and externalizing behaviors and achieving developmental milestones.[29-31] The CSKT Tribal Nation houses several innovative programs that all participants had utilized, noting several positive outcomes for their children. Partnering with Early Childhood Services (ECS) and receiving guidance and support from the Community Advisory Team members, Culture/Elder Committees and the Tribal Council allowed us to apply community-driven, CBPR and strengths-based approaches.

Strengths and limitations

This study contributes to the literature on types of activities and factors that promote or inhibit family-child engagement, specifically for families that have children with prenatal drug exposure. The community partner, ECS, had exemplary capacity to engage in research. Family Advocates were well-connected with families and their support contributed to the recruitment and interview process completion within three weeks. The Tribal Nation's investment helped to tailor our study tool by including questions that aligned well with the community context. Limitations included a limited sample size per family type, although selected participants provided rich information. Social desirability bias among biological parents may have led to underreporting their history of drug use in that illicit drug-use during pregnancy is a socially undesirable behavior. Information bias among caregivers may have occurred regarding their knowledge of the child's prenatal substance exposure.

Conclusions

Our study explored common family-child engagement activities as well as barriers, facilitators and positive child outcomes to activities among families with young children. A

number of key themes emerged from our work including the presence of the CSKT community that acts as a "bridge" to not only cultural and traditional identity and practice, but to several mentioned activities such as hosting powwows/celebrations, safe places to walk or run, a large lake and rivers to swim, and program resources for free books for families to read to their children. The importance placed on outdoor activities led us to consider greenspace as a potential resilience-promoting factor in this population in the next phase of our research.

As stated previously, the initial primary objective of the work described in this chapter was to use semi-structured interviews to inform development of a tool (i.e., Early Family-Child Engagement (ECCE) survey) that would be used as one of two exposures of interest in the very next step of my dissertation. Specifically, we planned to evaluate the impact of 1) ECCE survey score and 2) greenspace exposure on social-emotional development in early childhood in participants in CSKT ECS. We achieved the objective of developing the ECCE survey, and it was approved by Community Advisory Team members, CSKT ECS, Tribal Council, and the CSKT IRB. However, due to the COVID-19 pandemic which resulted in a nearly complete shutdown of research activities related to our work, we were unable to proceed with our planned next step to evaluate the impact of ECCE score and greenspace on social-emotional development. We shifted direction and applied some of the lessons learned from our semi-structured interviews to evaluate the potentially protective impacts of greenspace exposure on reducing mortality due to COVID-19.

Of special interest in the qualitative study described in this chapter was learning of the multiple underlying mechanisms of the Great Outdoors that promote a myriad of human health benefits. The primary author identified and learned of the multiple human health benefits that the natural environment, or "greenspace" affords to individuals across the lifespan. Such benefits

include attention restoration, exercise, reduced air pollution, and immune-regulation. A more thorough explanation of these underlying mechanisms is presented in detail in chapters 1 and 4.

In addition to allowing us to evaluate the potential protective impact of greenspace in the context of an extreme public health emergency, the greenspace/COVID project also provided us with the opportunity for training in greenspace assessment using satellite-derived leaf area index (LAI) data. It allowed us to establish feasibility of this exposure assessment approach which will be tremendously valuable once research can resume with our CSKT ECS partner. We present our study evaluating the relationship between greenspace exposure and COVID-19 mortality in detail in the next chapter (chapter. 4).

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CHAPTER 4

QUANTITATIVE STUDY 3: Greenspace exposure and COVID-19 mortality in the United States: January-July, 2020.

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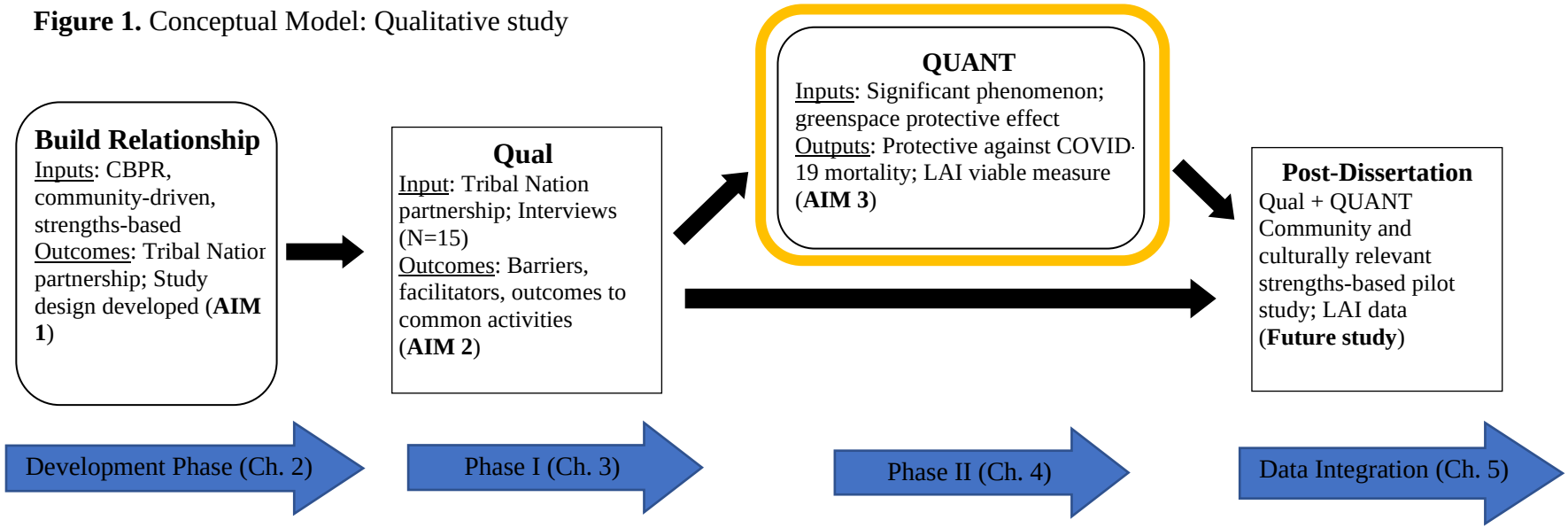
Figure 1. Conceptual Model: Qualitative study



Acronyms: CBPR = Community-based participatory research; LAI = Leaf Area Index; Qual = small qualitative study; QUANT = large quantitative study. Overall study uses an explanatory sequential mixed methods design. Data collection occurs in two phases: 1) qualitative interviews and 2) passive sampling of greenspace exposure via LAI deciles to inform future study.

Abstract

Background: Mortality from the novel coronavirus disease-2019 (COVID-19) continues to rise across the United States. Evidence is emerging that environmental factors may contribute to susceptibility to disease and mortality. Greenspace exposure promotes enhanced immunity and may protect against risk of mortality among those with COVID-19. Objectives: 1) Determine if high county level greenspace exposure is associated with reduced risk of COVID-19 mortality. 2) Demonstrate that Leaf Area Index ascertained as greenspace deciles is feasible in an epidemiological study design. Methods: Greenspace exposure was characterized in 3,049 counties across the conterminous United States using Leaf Area Index (LAI) deciles that were derived from satellite imagery via Moderate Resolution Imaging Spectroradiometer from 2011-2015. COVID-19 mortality data were obtained from the Center for Systems Science and Engineering at Johns Hopkins University. We used a generalized linear mixed model to evaluate the association between county level LAI and COVID-19 mortality rate in analyses adjusted for 2015-2019 county level average total county population, older population, race, overcrowding in home, Medicaid, education, and physical inactivity. Results: A dose-response association was found between greenness and reduced risk of COVID-19 mortality. COVID-19 mortality was negatively associated with LAI deciles 8 [MRR = 0.82 (95% CI: 0.72, .93)], 9 [MRR = 0.78 (95% CI: 0.68, 0.89)], and 10 [MRR = 0.59 (95% CI: 0.50, 0.69)]. Aside from LAI decile 5, no associations were found between the remaining LAI deciles and COVID-19 mortality. Increasing prevalence of counties with older age residents, low education attainment, Native Americans, Black Americans, and housing overcrowding were significantly associated with increased risk of COVID-19 mortality, whereas Medicaid prevalence was associated with a reduced risk. Discussion: Counties with a higher amount of greenspace may be at a reduced risk of experiencing mortality due to COVID-19.

Keywords: MODIS, LAI, Respiratory health, SARS-CoV-2

Introduction

The outbreak of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has spread rapidly across the world since December 2019. SARS-CoV-2 is highly pathogenic, transmissible, and has high morbidity and mortality among those that develop the novel coronavirus disease 2019 (COVID-19). On January 30, 2020, the World Health Organization (WHO) Director General declared the COVID-19 outbreak as a Public Health Emergency of International Concern (World Health Organization, 2020). In 2020, there were estimated to be about 352,700 deaths in the United States due to COVID-19 (Johns Hopkins & Medicine, 2020), reaching the third leading cause of death for persons aged 45 through 84 years and the second leading cause of death for those aged 85 years or older (Woolf et al., 2021)

Previous work has shown that patients in central China with a severe-type of COVID-19, classified as having respiratory distress, oxygen saturation ≤93%, and arterial blood oxygen partial pressure/oxygen concentration ≤200 mm Hg, compared to patients without symptoms, were more likely to: (1) be older in age; (2) have chronic conditions (hypertension, cardiovascular disease); (3) have symptoms of shortness of breath and fatigue; and, (4) have unhealthier levels of inflammatory cytokines, infection-related biomarkers (e.g., C-reactive protein), immunoglobin M, lymphocytes (e.g., neutrophil-lymphocyte ratio (NLR)), leukocytes, and T cells (Qin et al., 2020). These clinical characteristics indicate a dysregulated immune system that may cause people with an already weaker immune system (e.g., older adults with chronic conditions) to be more susceptible to severe cases of COVID-19 that further impairs their immune system (Qin et al., 2020).

Evidence is emerging that environmental factors, such as air pollution, exacerbate symptoms among COVID-19 patients (Copat et al., 2020). Air pollution is a major environmental cause for disease and premature death and may worsen COVID-19 severity by negatively impacting the human immune system (Copat et al., 2020; Gakidou et al., 2017). In contrast, greenspace exposure may reduce risk of COVID-19 mortality through multiple underlying mechanisms that include reduced air pollution and microbial diversity exposure. Early and long-term exposure to greenspace may influence mortality due to COVID-19 through the improved immune regulation pathway, as greenspace, particularly the natural environment, serves as a setting that provides exposure to microbial diversity, such as through soil, plants, and wildlife (Frumkin et al., 2017; Rook, 2013; Taylor & Hochuli, 2017). Socio-economic status among individuals and neighborhoods is an important predictor of the presence and utility of residential greenspace exposure and risk of morbidity and mortality outcomes. Studies have evidenced low levels of greenspace among low-income neighborhoods which may be due to individuals with higher socio-economic status choosing to move to greener neighborhoods (Brown et al., 2018; Engemann et al., 2019). Individuals with low socio-economic status compared to those with higher socio-economic status tend to experience larger reductions in risk of diseases (e.g., Alzheimer's Disease, circulatory disease) when exposed to increasing levels of greenspace (Brown et a., 2018; James et al., 2015).

To our knowledge, there has been no study to assess the association of greenspace exposure and COVID-19 mortality. We analyzed county level data comparing counties organized by greenness deciles to assess whether COVID-19 deaths were higher in counties with lower greenspace deciles.

Methods

All county level data used in the analysis were obtained from publicly available sources. Detailed information for the outcome variable, exposure variable and all covariates is provided in **Table 1**, including links to access the raw data.

COVID-19 Mortality Data

We obtained COVID-19 death counts at the county level from the COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU). JHU CSSE collects comprehensive county level COVID-19 data reported by several data sources (e.g., Centers for Disease Control and Prevention, World Health Organization) in real-time and provides the data as a repository for public access through the GitHub platform (Dong et al., 2020). JHU CSSE did not have COVID-19 data for 57 counties. Figure 2 showcases which counties are missing from analysis in the second map with a large number missing in Utah. In addition, at the time of this study, this data source had collapsed death counts into one data point ("New York City") across the Kings, Queens, Richmond, Bronx, and New York boroughs. Due to the extremely influential effect of the "New York City" data point on our model, it was removed from final analysis. In addition, we omitted the Ogata Lakota County due to this county having no listed adjacent counties in the United States Census Bureau county adjacency dataset described later in this paper, which was used to assess spatial autocorrelation in the model residuals using Moran's I test statistic.

Cumulative counts of COVID-19 deaths were obtained from January 21, 2020 to July 29, 2020. **Figure 1** displays a violin plot of the kernel probability density of COVID-19 deaths across Leaf Area Index (LAI) deciles, where LAI decile corresponds to 0-10%, 10-20%, and so on. Each violin represents one LAI decile group that includes a boxplot to indicate median value

and interquartile range of log COVID-19 deaths at the county level with dots representing outliers.

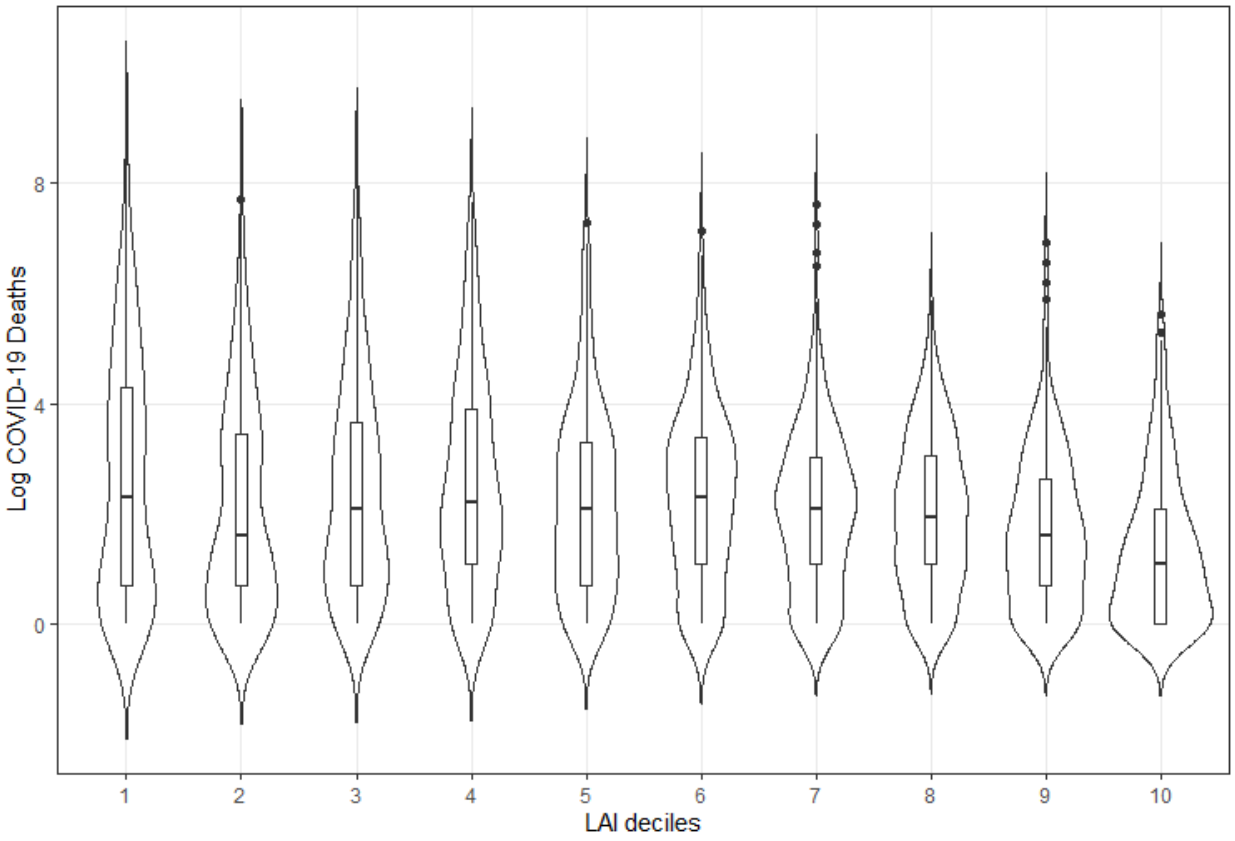


Figure 1: Violin plots of COVID-19 death counts by LAI decile among 3,049 counties. Each violin plot represents one LAI decile. Boxplots represent median values and interquartile range values of log-transformed COVID-19 deaths at the county level by LAI decile. Dots represent outliers.

Greenspace Exposure

Our exposure metric of primary interest was Leaf Area Index (LAI). LAI is defined as the leaf surface area per unit ground surface area. LAI has been often used in hydrologic or plant growth models and, more recently, in epidemiological studies providing evidence that greenspace exposure is associated with improved health outcomes (Engemann et al., 2019; Orioli et al., 2019). We developed 250 meter resolution annual maximum LAI maps for the

conterminous United States (CONUS) using data from the Moderate Resolution Imaging Spectroradiometer (MODIS) using the MOD13Q1 product 16-day vegetation indices. Each 16-day normalized difference vegetation index (NDVI) image was converted to LAI following methods described by Gitelson (Gitelson, 2004). We then extracted the mean 2011-2015 LAI average for each of the 3,049 United States counties. Following Engemann et al. (2019), we created equal deciles of LAI exposure at the county level to test for a dose-response association with COVID-19 mortality. For background, NDVI is an indicator using land surface reflectance of visible and near-infrared light reflected by vegetation that is displayed in a multispectral raster dataset. LAI is a transformation of NDVI that represents the number of layers of vegetation coverage and is highly correlated to NDVI but is more of a structural climate variable to aid in quantifying greenness (Fang et al., 2019).

Predictors of Covid-19 Mortality

We considered a number of predictors of COVID-19 mortality as potential covariates in analyses. A number of studies have found clinical, demographic, and environmental risk factors linked to COVID-19 mortality. Such clinical, demographic, and environmental risk factors include having chronic diseases, such as hypertension, diabetes, or coronary heart disease; being immunocompromised or having abnormal immunity; older age; male sex; disability; Black or Native American race; poverty; public insurance (e.g., Medicaid); obesity; days since first case reported in a county; air quality (e.g., PM2.5); hospital beds; overcrowding in home; and, education attainment (Abedi et al., 2020; Brandt et al., 2020; Millett et al., 2020; Price-Haywood et al., 2020; Tian et al., 2020; Wu et al., 2020; Zhao et al., 2020). Of these variables, the following were publicly available at the county level (see details in **Table 1**): percent with low education attainment, percent of overcrowding in home, percent on Medicaid as a proxy measure

for low socio-economic status, total population size, percent who are Native American and Black American races, percent ages 65 and over, and percent of physical inactivity as a proxy measure for chronic morbidity (e.g., heart disease, type II diabetes, various cancers) (Bull et al., 2004).

Statistical Analysis

We used negative binomial regression using the generalized linear mixed model (GLMM) 'glmmTMB' package (Brooks et al., 2017) in R version 4.0.2 (R Core Team, 2019) to evaluate the association between LAI decile and COVID-19 mortality. State was included in analyses as a random effect to account for variation in state mandates and recommendations to suppress the spread of COVID-19, which also partially accounts for spatial autocorrelation. Analyses were adjusted for education (No high school diploma or equivalent) prevalence , overcrowding (homes with a ratio of 1.01 or more per room) prevalence , Medicaid (18-64 years old) prevalence, older age (adults 65+) prevalence, Black and Native American race prevalence, physical inactivity prevalence, total county population, and average COVID-19 mortality among neighboring counties. This last covariate was added to the model as a predictor variable to account for spatial autocorrelation that was originally present in our model, resulting in uncorrelated residuals. We applied restricted maximum likelihood (REML) with a negative binomial link function, included state as a random effect, and applied a single zero-inflation parameter that, collectively, account for: (1) the number of parameters (fixed effects) by producing unbiased estimates of the variance components; (2) the presence of excess zeros; (3) overdispersion; and (4) state-level variability in our data. It is important to address all of these model features within the GLMM when working with clustered data (Takele et al., 2019).

Table 1. Outcome, explanatory and covariates used in study analysis with definitions, descriptions and source information.

Domain	Variable	Survey Description	Transformation	Source
Outcome variable:	COVID-19 deaths	County level COVID-19 death counts from 1/21/20 to 7/29/20	None	Johns Hopkins University the Center for Systems Science and Engineering (JHU-CSSE) Coronavirus Resource Center (https://coronavirus.jhu.edu/); URL: https://github.com/CSSEGISandData/COVID-19.
Explanatory variable:	Leaf Area Index (LAI)	LAI across the conterminous U.S (CONUS) at 250-meter resolution	Equal deciles of county level LAI	201-2015 MODIS, NDVI LAI. URL: https://topofire.dbs.umt.edu/public_data/helmsdeep1/health_projects/MODIS_data
Education	Less than a HS diploma or equivalent	Educational attainment for the population 25 years and over	Percent	US Census. 2015-2019 American Community Survey 5-year estimates. URL: https://www.census.gov/programs-surveys/acs/data.html
Overcrowding	Homes (rented and owned) with a 1.01 plus ratio of occupants per room	Tenure by occupants per room	Percent	
Socio-Economic Status	Adults ages 18 - 64 with Medicaid	Health insurance type by age	Percent	
Population	Total Population	Total population counts	Log-transformed	
Older age	65 years and older	Counts of individuals over 64 years old	Percent	
Race	Native American; Black	Percent of people who identify as Black or Native American.	Percent	
Health behavior	Physical inactivity	Percent of adults ages 20 and over reporting no leisure-time physical activity.	None	2016 United States Diabetes Surveillance System. URL: https://www.countyhealthrankings.org/explore-health-rankings/rankings-data-documentation

The GLMM used county population as an offset thus modeling COVID-19 rates on a log scale. Exponentiating results allows back-transformation of study findings to the original metric.

Collinearity was assessed among predictors within our full regression model by calculating variance inflation factors (VIF). VIF values of 5 or greater indicate a potential collinearity problem which implies that about 80 percent of an indicator's variance is accounted by a formative indicator within the model that is related to the same construct (Hair et al., 2011). The presence of collinearity can cause significant predictor variables to become nonsignificant. (Hair et al) For our model, all factors were less than 2.5 indicating no serious collinearity. All analyses were performed using R 4.0.2 software. Mortality rate ratios (MRR) with 95% confidence intervals (CI) were used to compare LAI deciles. MRRs are exponentiated parameters from the GLMM used to summarize main analysis findings and can be interpreted as the relative difference in the COVID-19 mortality rate associated with increasing LAI deciles compared to LAI decile 1 (counties with 0-10% LAI coverage).

Spatial Autocorrelation

We used Moran's I test statistic to assess spatial autocorrelation of COVID-19 mortality residuals. Similar to a spatial epidemic study on the COVID-19 outbreak, we defined neighbors as counties that share a border (Kang et al., 2020) and obtained lists of adjacent counties from the United States Census Bureau (https://www.census.gov/programs-surveys/geography/library/reference/county-adjacency-file.html). Values near 0 for Moran's I statistic indicate a lack of spatial autocorrelation; positive values indicate clustering of similar values and negative values indicate clustering of dissimilar values. Using a boundary-based neighborhood definition, a permutation test indicated insufficient evidence of spatial autocorrelation in the model residuals ($I = 0.0098$; $p = 0.16$). By incorporating the mean COVID-

19 mortality of a county's neighbors as a predictor variable and including state as a random effect in the model (see **Table 1** for details), we were able to adequately account for spatial autocorrelation and implement a zero-inflated, negative binomial mixed model for COVID-19 mortality.

Sensitivity Analysis

Rural/urban differences are not directly accounted for in our study due to a concern of high collinearity with the existing total county population variable that is used to calculate the COVID-19 response rate. In addition, we observed that urban settings have less greenness than rural settings in our study, and mortality due to COVID-19 may vary by rural/urban status. As a result, rurality may confound associations between greenspace and COVID-19 mortality. To identify confounding by rural counties, we conducted a sensitivity analysis similar to a separate study assessing air pollution on COVID-19 mortality to determine if counties with a small number of cases were overly influential (Wu et al., 2020). Specifically, we excluded counties with 10 or fewer confirmed COVID-19 cases to assess the robustness of our results (Wu et al., 2020).

Results

Overview

The study utilized findings from 3,049 counties across the CONUS. Of the 3,049 counties included in final analysis, 851 (27.9%) had zero reported deaths and 247 (8.1%) had 10 or fewer confirmed cases of COVID-19 as of July 29, 2020. **Table 2** provides characteristics of counties by LAI decile that were used in the final analysis. Total population counts, prevalence of Medicaid coverage, overcrowding in home, and race differed by decile.

1

Table 2. Selected characteristics of 3,049 counties by LAI decile.

	Greenspace (Leaf Area Index) by decile									
Variables	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile10
Total population: *n*	10,081,570	413,035	2,606,868	4,646,630	1,290,360	1,221,744	1,043,530	2,195,502	798,808	824,772
Over 64 [% (SD)]	18.7 (6.0)	20.5 (3.4)	19.0 (5.9)	19.0 (6.0)	18.9 (5.2)	18.4 (4.5)	17.8 (3.6)	18.1 (3.3)	18.7 (2.8)	19.2 (3.0)
No high school diploma or equivalent [% (SD)]	15.1 (8.7)	13.6 (6.3)	13.7 (7.5)	11.5 (5.6)	12.1 (5.4)	13.8 (6.0)	13.2 (5.2)	13.7 (5.7)	12.8 (5.3)	12.1 (5.2)
Medicaid [% (SD)]	11.4 (8.2)	15.3 (8.6)	9.0 (7.1)	8.4 (5.7)	9.6 (5.7)	10.1 (5.2)	10.1 (5.0)	11.6 (5.6)	11.5 (5.1)	12.0 (5.5)
Overcrowding [% (SD)]	3.4 (2.7)	1.6 (1.0)	3.2 (2.6)	2.8 (2.1)	2.2 (1.5)	2.3 (1.3)	2.1 (1.2)	2.0 (1.1)	1.8 (1.0)	1.6 (1.0)
Black [% (SD)]	5.6 (9.8)	2.1 (2.7)	4.0 (7.9)	6.6 (9.5)	14.4 (17.9)	17.1 (18.8)	15.2 (17.8)	14.5 (18.8)	9.5 (15.2)	3.7 (6.6)
Native American [% (SD)]	2.9 (8.5)	0.8 (5.2)	3.3 (10.6)	3.3 (10.5)	2.8 (7.3)	1.3 (3.8)	0.6 (2.3)	0.7 (2.6)	0.6 (1.6)	0.6 (3.5)
Physical inactivity [% (SD)]	24.9 (5.1)	25.9 (5.1)	26 (5.8)	28.4 (5.8)	28.8 (5.9)	28 (6.0)	29 (6.1)	28.5 (5.6)	27.6 (4.5)	27.8 (5.2)

Note: Data presented as percentages (%) are the combined estimated prevalence at the county level. LAI decile ranges, such as Decile 1 corresponds to decile 0 to 10%.

Figure 2 displays two maps of the spatial variation of LAI deciles across the CONUS and COVID-19 case fatality per 100 population. LAI density is more prominent in the eastern part of the country and west of the Rocky Mountain divide, where county populations tend to be larger.

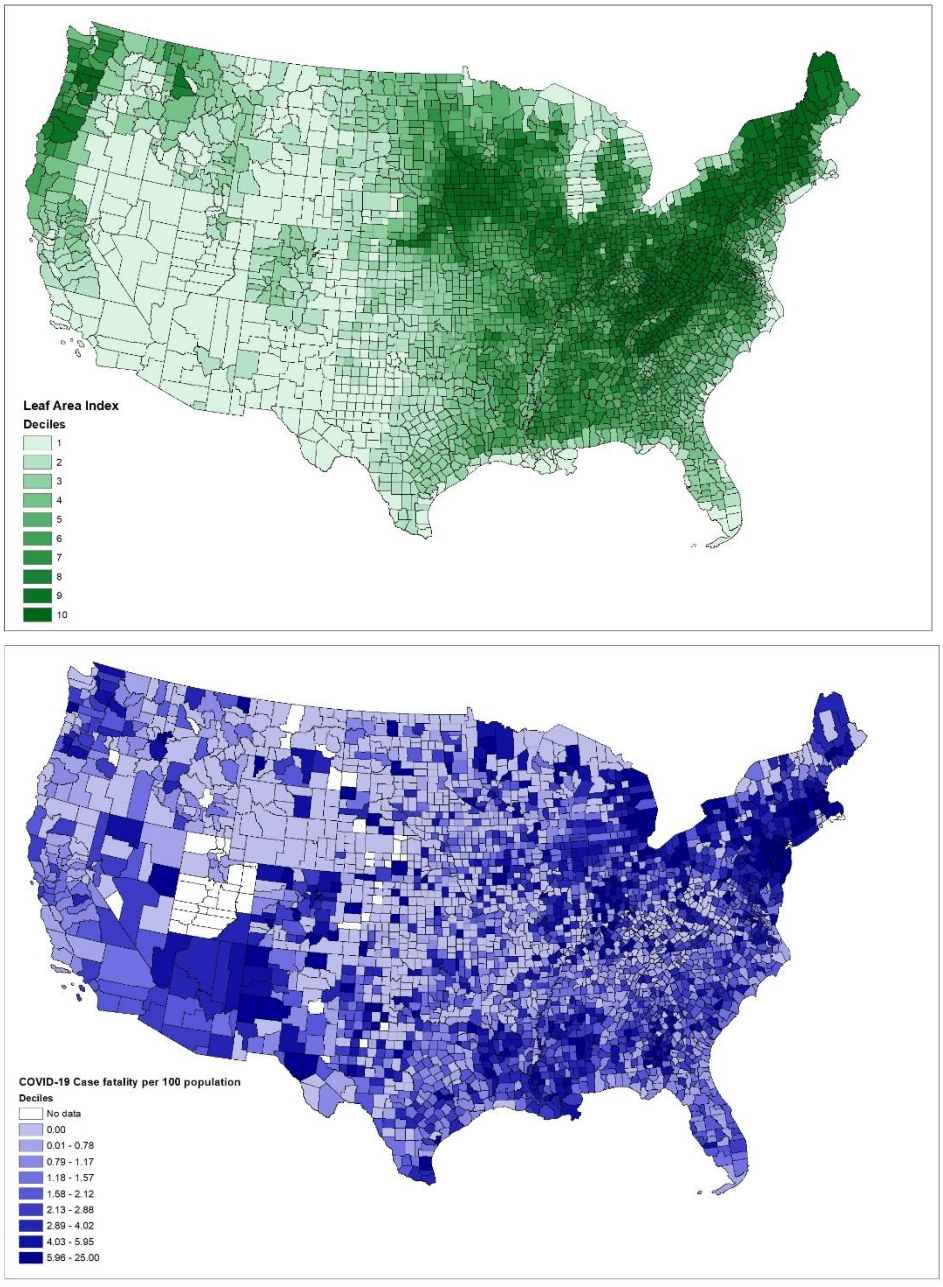


Figure 2: Side-by-side maps of Leaf Area Index (LAI) deciles and COVID-19 case fatality per 100 population by deciles for conterminous counties, U.S.A.

Main Analysis using LAI Deciles

A significant association was found between increasing LAI deciles and reduced COVID-19 mortality rate. **Figure 3** displays the unadjusted and adjusted Mortality Risk Ratios (MRR) for LAI deciles. The unadjusted MRR values make no adjustments for the effects of the model predictors. The adjusted MRR values use the negative binomial model coefficients to adjust these ratios based on the model predictions. In comparison to the lowest LAI decile 1 (0-10% greenness), counties within LAI deciles 8-10 have respectively, a 18% [MRR = 0.82 (95% CI: 0.72, 0.93)], 22% [MRR = 0.78 (95% CI: 0.68, 0.89)], and 43% [MRR = 0.59 (95% CI: 0.50, 0.69)] reduced risk for COVID-19 mortality. No corrections were made for multiple comparisons.

Subsequent analysis that was not published in the original article included restricting the sample to only include counties that overlapped with federally-recognized reservations and nations (N = 921) to determine if greenspace was also protective. The restricted sample was comprised of groupings of counties that were relatively small, highly variable in size (e.g., Navajo Nation vs Rocky Boy Reservation), and were located primarily in the Western half of the United States. These limitations were not suitable for the 1) model, which was designed for a large sample size; and 2) restricted counties because they were small, dispersed, and variable in size, which impacted our ability to calculate Moran's I test statistic to adequately assess the degree of spatial autocorrelation present in the model. As a result, we would have incurred major limitations if we were to interpret the adjusted MRR values for Tribal Nations and reservations.

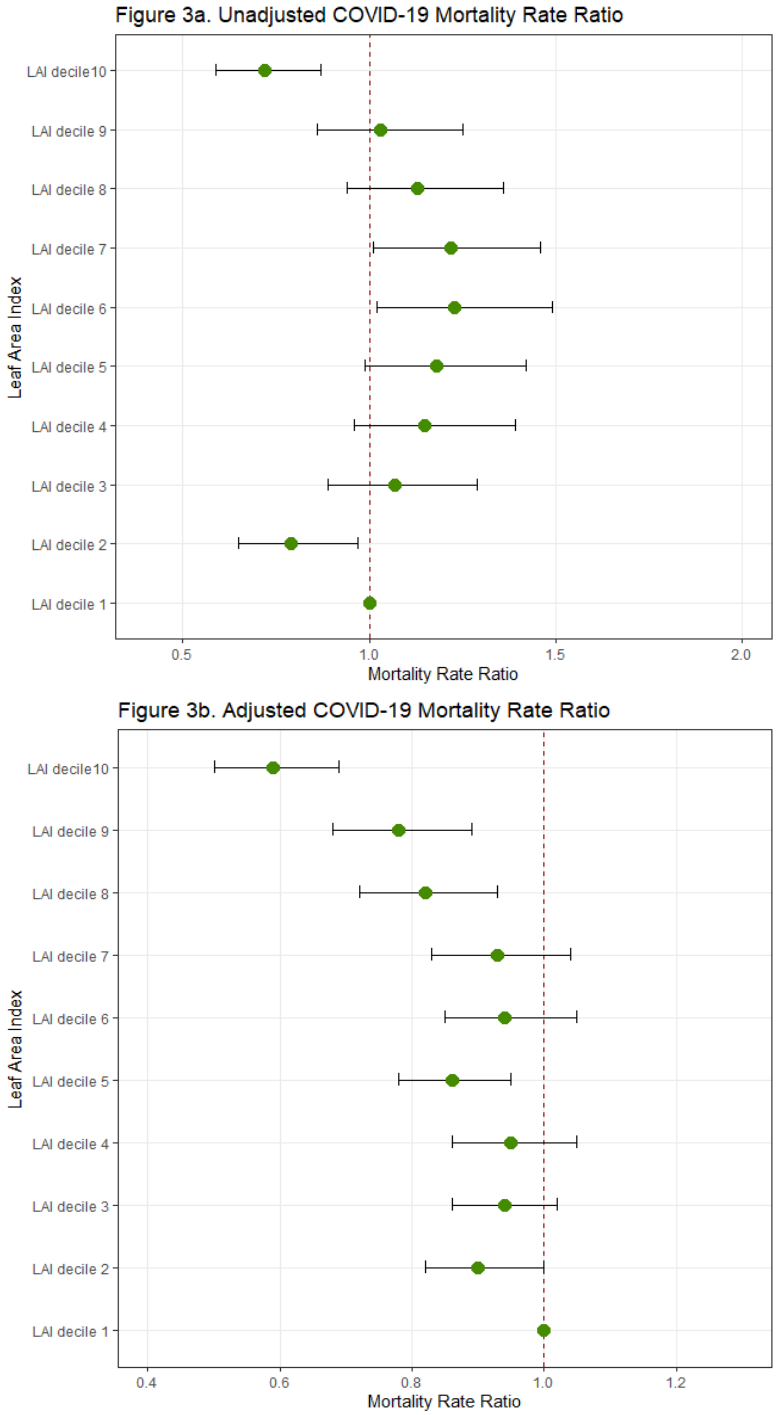


Figure 3: Unadjusted and adjusted COVID-19 Mortality Rate Ratio by LAI deciles. The unadjusted MRR values make no adjustment for the effects of model predictors. The adjusted MRR values use the negative binomial regression coefficients (95% CI) of COVID-19 death rates and exposure to greenspace (Leaf Area Index) by decile, adjusted for education, overcrowding, Medicaid (ages 18 – 64), age 65 and over, race (Black and Native American), physical inactivity, and neighbor COVID-19 mortality average. No corrections were made for multiple comparisons.

Significant Covariates

Counties with an increasing prevalence of Medicaid coverage among populations ages 18-64 years old were found to have a significant reduced risk of COVID-19 mortality (4% increase in MRR) [MRR = 0.98 (95% CI: 0.97, 0.99)]. We speculate a possible explanation for this is that workers who have lost their jobs during the COVID-19 pandemic likely had differential access to Medicaid in states that opted in for Medicaid expansion. For instance, while COVID-19 testing has been largely covered by the government, treatment for the COVID-19 has not (Woolhandler & Himmelstein, 2020).

Counties with an increasing prevalence of Native Americans (2% increase in MRR) [MRR = 1.02 (95% CI: 1.02, 1.03)], Black Americans (2%) [MRR = 1.02 (95% CI: 1.02, 1.02)], low education attainment (5%) [MRR = 1.05 (95% CI: 1.04, 1.06)], overcrowding (5%) [MRR = 1.05 (95% CI: 1.03, 1.08)], and aged 65 and over (4%) [MRR = 1.04 (95% CI: 1.03, 1.04)] were found to have significant increased risk of COVID-19 mortality.

Sensitivity Analysis for Unmeasured Confounding Findings

Our study findings remained significant for LAI deciles 8 – 10 when conducting the sensitivity analysis. MRR values of COVID-19 mortality for LAI deciles among only counties with greater than 10 confirmed COVID-19 cases produced nearly identical results to those displayed in Figure 3. Thus, the analysis was insensitive to measures of COVID-19 mortality in counties with small numbers of cases.

Discussion

We found a reduced COVID-19 mortality rate with high greenspace values. Specifically, a dose-response association was present between LAI exposure, particularly between the top 3

greenspace deciles, and reduced risk of COVID-19 mortality. Table 3 summarizes the objectives, innovation, study design, population, exposure and outcome measure, outcome and results of this study. Our study findings add to the literature of the potential protective effect of greenspace exposure via LAI, on the risk of COVID-19 mortality.

This is the first ecological study to assess the association between greenspace exposure and mortality prevalence of those contracting the novel Coronavirus disease 2019. In addition, LAI deciles was demonstrated to be a viable measure to ascertain greenspace exposure that will used in our study to assess the association between high levels of residential greenspace exposure and child social-emotional development.

Other studies have found associations between greenspace exposure and positive health impacts citing various underlying mechanisms. Low-income neighborhoods and populations with low socio-economic status have experienced lower presence of or lower access to greenspace exposure compared to higher income neighborhoods; however, individuals with a low socio-economic status background tend to utilize greenspace more and demonstrate greater benefits in reduced risk of diseases compared to their higher-income counterparts (James et al., 2015; Brown et a., 2018; Jarvis et al., 2020). Such findings demonstrate the substantial positive impact greenspace has for low-income neighborhoods and among individuals with low socio-economic status.

In a series by Rook et al. (2017), authors assert that early and continued exposure to the natural environment evidences a protective effect against inflammation-associated diseases brought about by the increasing exposure to novel pathogens that are transmitted by means of crowding due to a growing population (Rook et al., 2017).

Table 3. Quantitative study components and summary.

Objectives	**Innovation**	**Study design**	**Population**	**Exposure**	**Outcome**	**Results**
1) Determine if greenspace exposure is associated with reduced risk of COVID-19 mortality. 2) Demonstrate LAI ascertained as greenspace deciles is feasible in future study.	Limited knowledge on protective exposures against risk of COVID-19 mortality. The biophilia hypothesis indicates greenspace may be protective against COVID-19 mortality primarily through immunoregulation and reduced air pollution.	Cross-sectional	All individuals across 3,049 counties in the conterminous U.S.	LAI deciles	Risk of COVID-19 mortality	1) Dose-response association for top three LAI deciles compared to LAI decile 1 (0-10% greenness) in significant reduced risk of COVID-19 mortality. 2) LAI deciles are a feasible approach to ascertaining greenspace exposure to inform a future study.

Notes. LAI = leaf area index; COVID-19 = Coronavirus disease 2019.

Specifically, authors note the underlying mechanism is exposure to immunoregulation-inducing macro- and microorganisms found in soil, plants and wildlife that are all housed in natural environments (Rook et al, 2017). Of primary interest is the recent assertion that clinical adverse outcomes from COVID-19 are linked to immunity by means of having a diverse gut microbiota, which is influenced by a combination of early exposure to environmental factors, genetics, and diet (Dhar and Mohanty, 2020).

Several underlying mechanisms of greenspace exposure that positively impact human health are discussed in depth by Frumkin et al. (2017), which include psychological benefits, social contact, physical activity, and improved air quality (Frumkin et al., 2017). We speculate that immunoregulation and reduced air pollution are likely underlying mechanisms that explain the observed association between higher levels of greenspace exposure and reduced risk of COVID-19 mortality. We assume that the shared underlying mechanisms being the immune system and air pollution, are differentially impacted by our study exposure and outcome. As mentioned previously, COVID-19 severity has been linked to air pollution and weaker immune systems, which may cause high-risk individuals to experience worse conditions from the virus inducing a cytokine storm and further damaging tissue (Qin et al., 2020; Wu et al., 2020). In contrast, greenspace exposure has been linked to reduced air pollution and improved immune functioning capacity (Dadvand et al., 2012; Marselle et al., 2019; Paciência et al., 2020).

Strengths and Limitations

Strengths of our study include the inclusion of leaf area index (LAI) as an indicator of greenspace exposure. LAI also provides quantification of greenspace by measuring layers of plant growth increasing the sensitivity of correctly identifying natural environments, such as forested areas, that often are home to wildlife and other immunoregulation-enhancing benefits. In

addition, we had sufficient variability at the county level to detect differences in greenness and COVID-19 mortality outcomes. Our study findings may be relevant to other countries with similar socio-economic status and physical features. Our approach may be used to incorporate random effects, such as state-level policies around COVID-19 testing and mandate efforts (e.g., requiring mask in public settings) in future studies.

Our study had several limitations. Unmeasured confounding is of primary concern in that we rely mainly on ecological measures at the county level that do not account for potential individual-level confounding factors and do not account for regional variations of outbreaks. There are several potential factors that are relevant to risk of COVID-19 mortality that were not addressed in our study. For example, we did not directly measure comorbidities, such as hypertension, coronary heart disease, or diabetes, or air pollution status. Failure to include the five boroughs in New York that comprise "New York City" due to having too great of an effect on the model was a limitation in that these boroughs were once the epicenter of the COVID-19 outbreak and had a low LAI decile during the study period. In addition, there have been significant land coverage changes over time that may hinder the representation of greenspace exposure. For instance, one study found that approximately 4% of forests were lost from 2001 to 2016 in the conterminous United States (Homer et al., 2020). Lastly, although physical inactivity is a proxy measure for select chronic conditions that have been found to be risk-factors for the study outcome, the absence of direct measures further limits our study findings.

Conclusion

Our study findings indicate a dose-response association between greenspace and reduced risk of COVID-19 mortality as seen in **Figure 3**. Climate change may influence infectious disease outbreaks and subsequent disease-related mortality and morbidity as we continue to experience

pollution and diminishing greenspaces (Marselle et al., 2019). Future studies might update the current study when more up-to-date measures become available, such as the 2020 U.S. Census data. It would also be worthwhile to control for important COVID-19 mortality risk-factors discussed earlier that can be measured at the individual level. The public health impact from our study findings point to the need to preserve our natural environments and partner with various fields to increase greenspace in cities to protect human health.

Careful consideration for measuring greenspace exposure is crucial in epidemiological studies where researchers should consider types, sources, and definitions that are both sensitive and specific to the study outcome of interest. For instance, we will measure in a future study both quantitative residential greenspace exposure by LAI deciles and qualitative human-environment interaction as this interaction is often missed in study designs.(Frumkin etal) We intend to utilize the greenspace exposure variables to determine “how much” and “what type” of greenspace may be protective among young children’s social-emotional development to determine if greenspace has a cumulative protective effect, independent of or combined with other early protective exposures, such as positive family-child engagement.

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CHAPTER 5: CONCLUSION

This section provides a summary of the study findings across all three completed studies. Findings are also shared in terms of contributions and relevance to public health, overall strengths and limitations, future directions, and conclusions.

1. Summary of Research Findings

The first study (chapter 2) occurred during the development phase of our research. This study focused on relationship-building with a Tribal Nation with the goal of establishing a community research partner to develop a robust study design aimed at identifying family-child engagement activities as resilience factors across the community, culture, outdoor and home settings. Several unique challenges and solutions and key outcomes occurred during this phase. The main study outcomes were the successful collaboration with the Confederated Salish and Kootenai Tribes (CSKT) Early Childhood Services (ECS) as our primary study partner and the development of a robust study design. Key factors leading to the partnership involved applying Community-Based Participatory Research (CBPR), strengths-based, and community-driven approaches to co-identify and co-develop a study that would be robust and acceptable to community stakeholders, such as the CSKT Tribal Council, Salish Culture Committee, Kootenai Culture Committee, and the Salish Kootenai College Institutional Review Board. Several studies have applied CBPR, strengths-based, and/or community-driven approaches when collaborating with an Indigenous community and yielded robust research findings and continued collaboration.[1-8]

The qualitative study (chapter 3) occurred during phase I. This study aimed at identifying common family-child engagement activities, and barriers, facilitators and child positive outcomes to those activities among biological and non-biological caregivers to young children

that had and did not have prenatal substance exposure and resided in the CSKT Tribal Nation. Key findings were that biological parents to a child with prenatal substance exposure mentioned participating in more culture-specific activities and events and some outdoor activities compared to their counterparts to children without prenatal substance exposure. An emergent inductive theme occurred across a few participants that either had a family history of substance misuse or their child had prenatal substance exposure where they experienced familial barriers to cultural/traditional identity and practice. However, this familial barrier seemed to be attenuated through community-hosted cultural activities and events that their children were able to participate in. For instance, one caregiver to a child with prenatal substance exposure shared that the cultural event their child was able to attend was supported by the community and this was the first time their child participated in their culture. Thus, the community acted as a 'bridge' to support and encourage a sense of cultural identity and traditional practice among all families.

The quantitative study (chapter 4) occurred during phase II and during the COVID-19 pandemic. COVID-19 mortality and greenspace exposure were measured at the county level across the conterminous United States to determine if greenspace was associated with a reduced risk of mortality among those contracting COVID-19. Greenspace was characterized using Leaf Area Index (LAI) deciles at the county level. Counties within the top three LAI deciles demonstrated evidence of a dose-response association between increasing deciles of greenness and reduced risk of COVID-19 mortality. Older age residents, low education attainment, Native Americans, Black Americans, and housing overcrowding were all significantly associated with risk of COVID-19 mortality in which support previous study findings measuring risk factors for COVID-19 mortality. These findings will inform future research measuring greenspace exposure noting that the top LAI deciles may also have a protective effect on other health outcomes. As

discussed in chapter 4, the research context needs to be taken into consideration when defining and measuring greenspace exposure as there are likely differing underlying mechanisms between greenspace and the outcome of interest.[9]

2. Public Health Contributions

My doctoral research adds to the literature in several ways. Overall study findings centered on innovative ways to identify and measure resilience-promoting factors. Specifically, no measure existed at the time of my research that encompassed positive family-child engagement activities that were both cultural-specific and community-relevant among children with prenatal substance exposure that resided in a Tribal Nation. In addition, no research had been done at the time of my research that measured greenspace exposure by LAI as a potential resilience-promoting factor against risk of COVID-19 mortality.

Results presented in chapters two through three provide evidence that the CSKT Tribal Nation has established strengths and resources that align with their community, cultural and traditional identities and may be protective against social-emotional behavioral problems among young children with prenatal substance exposure. In addition, greenspace exposure was found to have a dose-response association in reduced risk of COVID-19 mortality likely due to the established pathways of reduced air pollution and increased immunity that support several areas of human health.

3. Public Health Relevance

Historical and contemporary trauma has contributed to substantial health disparities in Native American communities including higher rates of substance misuse,[10-13] including among pregnant Native youth.[14] These statistics indicate a need to prioritize the wellbeing among Native

Americans, particularly Native American pregnant women and their children. Children with prenatal substance exposure face a plethora of health and safety concerns both directly and indirectly related to substance exposure.[15] Such problems might include low birthweight, experiencing neonatal opioid withdrawal syndrome (NOWS), and impaired bonding with the parent.[15] As a result, it is critical to develop and test culturally congruent interventions as innovative approaches to addressing the unique circumstances afflicting Native communities that often include social, cultural, historical and spiritual determinants.[16] Indigenous communities are also a source of resilience and resistance for the long-term wellbeing among Native youth. Such communities promote a sense of family connectedness and are a place to practice tribal traditions, both of which are valuable strengths to target in future intervention work.[17]

Our work has provided a platform for future intervention studies by 1) sharing strategies to successfully partner with a Tribal Nation to develop a robust strengths-based study on a sensitive topic with a highly stigmatized population that is beneficial and of interest to the tribal community; 2) identifying common cultural-sensitive and community-relevant family-child engagement activities among families to children with prenatal substance exposure in one Tribal Nation; 3) showcasing the feasibility of Leaf Area Index (LAI) as a measure of greenspace exposure in an epidemiological study; and 4) providing evidence that greenspace exposure has a dose-response association in reduced risk of COVID-19 mortality that merits consideration for future intervention research on risk of mortality against respiratory-related diseases like COVID-19.

The evaluation of the association between greenspace and COVID-19 mortality is important because the study findings indicate the possible multiple benefits to frequent and preserve the natural environment in the context of emerging infectious disease outbreaks linked

to climate change that have devastating impacts on human safety and wellbeing. Tribal Nations have also experienced a scarcity of resources that put many Native Americans residing in Tribal Nations and reservations at risk of morbidity and mortality.

The COVID-19 pandemic posed major challenges across numerous Tribal Nations, resulting in lock downs, closures of schools and key services, stressors on health care systems, and overwhelming grief from the loss of relatives and cultural knowledge keepers in Tribal Nations. While the importance of research has been emphasized during this unprecedented time, community-based studies with Native populations have faced particular challenges. For instance, our ongoing research was stalled and required last-minute adaptations to the changing dynamics, which included modifying our study design, data collection procedures, participant engagement efforts, and analytic strategies. Funded research will resume for the 2020-2021 fiscal year. The future feasibility study is discussed at the end of this chapter.

4. Overall Strengths and Limitations

The research presented in the preceding chapters had a number of strengths. The first and second studies in chapters 2 and 3 incorporated CBPR as a primary study approach which is the "gold standard" for research with Indigenous populations,[16] and helps to avoids the common and problematic "helicopter researcher" experience that has created a history of mistrust between tribal communities and researchers.[18-22] The successful and continued collaboration with CSKT Early Childhood Services is a significant strength that indicates established trust between researchers and CSKT. The second study also identified types of activities and factors that promote or inhibit family-child engagement specific to families that have children with prenatal drug exposure which avoids adapting an existing study measure in future research. The final study in chapter 4 utilized LAI as the greenspace exposure which was sensitive to detecting a

dose-response association in risk of COVID-19 mortality. In addition, LAI is better able to detect immune-boosting greenspace features by quantifying layers of greenness that is associated with plant growth.[23] The final study also had a large sample size which consisted of the conterminous United States.

There were several study limitations. The first limitation consisted of the inability to successfully partner with a second Indigenous community due to time and resource constraints. Due to the sensitive topic, some caregivers, particularly biological parents, may not have accurately reported their child's prenatal substance exposure status. In addition, some non-biological parents/caregivers may not know their child's history of prenatal substance exposure. Identified common family-child engagement activities and factors that promote or inhibit activities are specific to the CSKT Tribal Nation and may not be generalizable to other communities.

Last, but not least, was the COVID-19 global pandemic. Research was halted for approximately one year requiring us to substantially alter the initially planned project. The final study (chapter 4) had limitations in terms of unmeasured confounding, inability to account for individual-level outcomes, not including five boroughs in New York that comprise "New York City" that was once the epicentre of the COVID-19 outbreak, land coverage changes over time and the nature of the ecological study design in that we cannot infer causation between greenspace and COVID-19 mortality. LAI has inherent limitations in that is derived from satellite imagery and is subject to missing information due to cloud coverage, for example. LAI is also a passive measure of greenspace exposure, so we cannot determine human-environment interaction which is a recommended approach that is warranted in future research.[24] Social determinants of health, including racism may also impact availability of quality greenspace as

low-income neighborhoods tend to have low levels of greenspace.[25,26] The ecological study design is subject to the ecologic fallacy in which the observed association in this study may not be true at the individual level. Bias might also arise due to individual-level unmeasured confounders, such as social determinants of health (e.g., poverty, limited healthcare access), chronic conditions or environmental features (e.g., outdoor and indoor air pollution) that may have a stronger effect on associated risk of COVID-19 mortality compared to greenspace exposure. Such risk factors are also particularly prominent in Tribal Nations.[27,28]

5. Conclusion and Future Directions

Little is known about the far-reaching impacts between early and continued exposure to resilience factors such as family-child engagement and greenspace exposure on wellbeing in Tribal Nations. Findings from the first two studies (chapters 2 and 3) indicate that there are several community-sponsored activities and events occurring in the cultural, community, outdoors and home settings for families with young children that live in the CSKT Tribal Nation. The study outcomes and findings indicate community commitment to child and family wellbeing.

Place is a critical contextual factor that provides a sense of community, cultural and traditional identity and way of being that is often complex and strongly associated with the overall health and wellbeing among individuals. Study findings indicate that traditional knowledge and practices are being restored by the CSKT Tribal Nation. Resilience- and strengths-based studies merit attention and inclusion in Native American research. I am honored that our research had the overall intention to identify and measure resilience factors in the context of social and emotional wellbeing among families.

Of special interest was the finding discussed in chapter 3 that families to children with prenatal substance exposure mentioned frequenting the outdoors more than their counterparts to children without prenatal substance exposure. The CSKT Tribal Nation is located in a forested area and is comprised of several towns in locations ranging from rural and isolated to non-metro urban. Chapter 4 demonstrated the feasibility to measure greenspace exposure using LAI in the context of an epidemiological study design and may be applicable to a future study in the CSKT Tribal Nation. CSKT has the capacity to determine if early exposure to the natural environment measured via LAI is associated with a reduced risk in child social-emotional behavioral problems among high-risk children being those with prenatal substance exposure. In addition to residential greenspace exposure measured by LAI, we will also ascertain exposure through the "Outdoor" domain in the novel *Early Family-Child Engagement (EFCE)* survey to accurately measure child-environment interaction.

My dissertation research has laid the groundwork for future research that will evaluate the impact of the two resilience factors of primary interest in my doctoral work—caregiver-child engagement and greenspace—on social and emotional development in children with prenatal substance exposure. Specifically, we will quantify early family-child engagement and residential greenspace exposure against social and emotional development among children ages 1-3 years old with and without prenatal substance exposure that reside in the Confederated Salish and Kootenai Tribes community.

Participants will complete the novel culturally congruent and community-relevant quantitative *Early Family-Child Engagement (EFCE)* survey that was designed to measure: 1) type by domain (cultural, community, outdoor, home), amount and duration of family activities common from birth to age 3. Greenspace will be measured using LAI deciles. The 250 meter

resolution annual maximum LAI maps were derived from the Moderate Resolution Imaging Spectroradiometer (MODIS) using the MOD13Q1 product 16-day vegetation indices. Each 16 day normalized difference vegetation index (NDVI) image was converted to LAI following methods described by Gitelson (2004).[29] Participants will complete the Brief Infant-Toddler Social and Emotional Assessment (BITSEA) parent form, which is a screener tool to assess social emotional and behavioral problems.[30] The BITSEA has excellent test-retest reliability, good inter-rater reliability agreement, and demonstrated criterion-related validity, discriminant validity and predictive validity,[31] and is sensitive to changes such as early intervention.[32] Two scales comprise the BITSEA: 1) *problems* in areas of externalizing, internalizing, dysregulation, and rare behaviors; and 2) *competencies* related to attention, compliance, mastery motivation, etc. I will utilize linear regression adjusting for possible confounders and child's prenatal substance exposure status to evaluate the impact of family-child engagement and greenspace exposure on social and emotional behavioral development.

Adequate power will be difficult to obtain. Families with a history of substance abuse are often difficult to identify and recruit and may impact this study achieving an adequate sample. I anticipate recruiting 30 participants (15 with prenatal substance exposure; 15 without prenatal substance exposure) on the basis of feasibility of study completion and will obtain through this sample estimated effect sizes needed to design a future, larger study. Assuming a sample size of 30, alpha = 0.05, and 80% power, I expect to detect a large effect on a continuous outcome between study groups. For example, a standard deviation of 7.7 in the *total problems* score (age group: 18-23 months),[33] the minimum detectable change in score associated with having possible behavioral problems in this scale is 8.2, which may not detect minimally important differences.

Reporting and recall bias will likely occur among caregivers when assessing child's prenatal substance exposure status and child-environment interaction. Non-differential bias may occur between biological caregivers and non-biological caregivers. To remedy reporting bias, we will actively assure participants that their responses will be kept confidential by separating their identifiable information from their interviews. Translation and dissemination of study findings will incorporate critical Indigenous pedagogy (CIP), which is a method used to discuss social injustices and addresses inequities and oppression in education with the goal of creating social change.[34] Indigenous Research Methods (IRM) will be applied to the translation of study findings by creating digital stories which promote critical reflection of the study results for both storyteller and listener.[35] Lastly, sustaining our partnership with Early Childhood Services (ECS) is critical to carry out and complete the future study and is subject to several challenges such as limited funding, and in-person and travel restrictions. Maintaining regular communication and participating in community events when invited are two approaches that will be used to maintain our relationship with ECS and the larger CSKT community should we come across funding or in-person challenges. Well-established protective factors associated with child behavioral development applied in the context of prenatal substance exposure can shed light on impactful community interventions that support sustainable efforts in promoting healthy development, particularly among children with prenatal substance exposure.

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APPENDICES

APPENDIX A. Informed Consent

Informed Consent Form

Resilience to the impacts of prenatal substance use exposure in a tribal setting

You are being asked to participate in a voluntary research study. The purpose of this study is to find and measure factors that promote positive child development and behavior. Being in this study will involve participating in an interview in which you are asked about what does and does not support bonding with your child in community, home, and outdoor settings. The interview will last about one hour and 30 minutes. Although private information will be treated with the utmost care, breach of confidentiality is a risk. You may have discomfort about sharing barriers to positive family-child activities. Although you may not directly benefit from taking part in this study, your participation may help to identify activities that support healthy development of children with and without prenatal drug exposure.

Principal Investigator: Erin Semmens, Assistant Professor
Department and Institution: School of Public and Community Health Sciences, University of Montana
Contact Information: 32 Campus Drive, Missoula, MT 59812; (406) 243-4446

Why am I being asked?
You are being asked to be a participant in a research study about positive family-child engagement activities that may support improved development and behavior outcomes among children, ages 0 -3 years old with and without prenatal drug exposure. The purpose of this research is to identify barriers and supports to resilience-promoting resources in improving development and behavior outcomes for children. You have been asked to participate in this research because you are a primary caregiver to a child ages 0-3 years old.

Your participation in this research is voluntary. Your decision whether or not to participate will not affect your current or future dealings with Salish Kootenai College or the researchers. If you decide to participate in the research, you are free to withdraw at any time without affecting those relationships.

What procedures are involved?
The study procedures include an in-person interview in which you will be asked about types of barriers and supports to activities, events or services that your child and you or another family member participate in or would like to participate in in your community, at home and outdoors.

This research will be performed at one of the CSKT Early Childhood Services office sites. You will need to come to the study site at least once and no more than twice to complete the interview. The interview will last one hour and 30 minutes. We will then provide you your responses from the interview by either e-mail or mail for you to review and make final changes.

What are the potential risks and discomforts?
Your participation in this study involves no more than minimal risk. The proposed methods to assess caregiver-child engagement and developmental and behavior outcomes include non-invasive procedures. If you have concerns that your child may have a developmental and/or behavior problem, CSKT Early Childhood Services will provide you with resources and referral information. Although private information will be treated with the utmost care, breach of confidentiality is a risk.

Are there benefits to participating in the research?
Although you may not directly benefit from taking part in this study, your participation may help to identify activities that support healthy development of children with and without prenatal drug exposure.

What other options are there?
You have the option to not participate in this study.

Will my study-related information be kept confidential?
We will use all reasonable efforts to keep your personal information confidential, but we cannot guarantee absolute confidentiality. When this research is discussed or published, no one will know that you were in the study. But, when required by law or college policy, identifying information (including your signed consent form) may be seen or copied by: a) The Institutional Review Board that approves research studies; b) auditors responsible for oversight of research; or c) Federal regulatory agencies such as the Office of Human Research Protections in the Department of Health and Human Services.

Will I be reimbursed for any expenses or paid for my participation in this research?
You will receive $50 for an interview at a CSKT Early Childhood Services office site. Snacks and non-alcoholic drinks will also be provided on-site.

Can I withdraw or be removed from the study?
If you decide to participate, you are free to withdraw your consent and discontinue participation at any time. The researchers also have the right to stop your participation in this study without your consent if they believe it is in your best interests or if you were to object to any future changes that may be made in the study plan.

Will data collected from me be used for any other research?
Your de-identified information could be used for future research without additional informed consent.

Who should I contact if I have questions?
Contact the researcher, Erin Semmens, Principal Investigator, at (406) 243-4446 or erin.semmens@umontana.edu if you have any questions about this study or your part in it, or if you have concerns or complaints about the research.

What are my rights as a research subject?
If you have any questions about your rights as a participant in this study, please contact the Salish Kootenai College Institutional Review Board at (406) 275-4931.

I have read the above information. I have been given an opportunity to ask questions and my questions have been answered to my satisfaction. I agree to participate in this research. I will be given a copy of this form.

_____ _____

Signature Date

_____

Printed Name

_____ _____

Signature of Person Obtaining Consent Date

_____

Printed Name of Person Obtaining Consent

Statement of Consent to be Audiotaped:
I understand that audio may be taken during the study, and I consent to being audio recorded.
I understand that audio recordings will be destroyed following transcription, and that no identifying information will be included in the transcription.

_____ _____

Subject's Signature Date

Future studies?
It is also possible that we may contact you at some point in the future to help us with new research questions or to share a summary of findings from this study. If we ask you to join in another study, you would be informed about the study in detail.

If you DO NOT want to be contacted in the future, please initial here: _____

APPENDIX B. Memorandum of Agreement

MEMORANDUM OF AGREEMENT

BETWEEN

UNIVERSITY OF MONTANA

&

CONFEDERATED SALISH AND KOOTENAI TRIBES EARLY CHILDHOOD SERVICES

MEMORANDUM OF AGREEMENT

This memorandum of agreement ("MOA") is made and entered into June 5, 2020, ("Effective Date"), by and between the University of Montana, an institution of higher education in the state of Montana having its principal office at 32 Campus Drive, Missoula, Montana 59812 ("UM"), and the Confederated Salish and Kootenai Tribes Early Childhood Services, a department of the Confederated Salish and Kootenai Tribes located at 35401 Mission Drive (Neil Charlo Building), P.O. Box 1510, St. Ignatius MT, ("CSKT ECS"), (Hereinafter collectively referred to as the "Parties" and each individually as a "Party").

NOW, THEREFORE, in consideration of the promises and mutual covenants contained herein, the Parties hereto agree as follows:

SECTION 1: DEFINITIONS

The following terms are used in this MOA as defined below:

1.1 "AIAN" means American Indian and Alaskan Native.

1.2 "CAT" means the Community Advisory Team of approximately four community members from across the Flathead Reservation who have an interest in engaging in this research area, and who have committed to participating in regular meetings with Research Team.

1.3 "CSKT" means the Confederated Salish and Kootenai Tribes.

1.4 "CSKT Partners" means Jeanne Christopher, Director and Paula Wofford, Grant Manager collectively. Both are current employees of CSKT Early Childhood Services.

1.5 "ECS" means Confederated Salish and Kootenai Tribes Early Childhood Services, which houses Early Head Start, Head Start, Salish Language Nest (Salish language immersion program for children 0 -5 years of age), and Home-Visiting.

1.6 "CSKT Culture Committees" means both the Kootenai Culture Committee and the Selis-Qlipse Culture Committee.

1.7 "Research Team" means CSKT Partners, CSKT Project Lead, Project Principal Investigator (PI), UM Project Lead, UM Personnel, and UM Community Research Navigator collectively or individually.

1.6 "CSKT Project Lead" means Jeanne Christopher individually.

1.7 "AIAN CTRP" means the American Indian and Alaska Native Clinical and Transitional Research Program, who has funded the phase of this research from August 1, 2019 – July 31, 2020.

1.8 "AIAN CTRP Grant" means National Institutes of Health grant No.: NIGMS 5U54GM115371-04.

1.9 "Material" means anything that is created or developed under this MOA and in which copyright exists, including but not limited to research journal publications.

1.10 "Outputs" (see Section 3) means the tangible or physical results of the Project such as activities, materials, products, etc. that support the achievement of the Common objectives as set forth in Section 2.

1.11 "Outcomes" (see Section 3) means the level of performance or achievement that relates to the outputs.

1.12 "Project" means everything that is planned to be jointly accomplished by the Parties.

1.13 "Project PI" means Erin Semmens, PhD of the University of Montana, who is the Principal Investigator of this Project.

1.14 "UM Community Research Navigator" means Niki Graham, MPH who is a current UM employee.

1.15 "UM Personnel" means Erin Semmens, PhD, Paul Smith, DO and Helen Russette, MPH collectively or individually.

1.16 "UM Project Lead" means Helen Russette, MPH individually.

SECTION 2: PURPOSE AND COMMON OBJECTIVES

2.1 Purpose. Under this MOA, the Parties have the overall goal to identify, measure, and implement resilience-promoting strategies that translate to improved well-being among American Indian children prenatally exposed to opioids or other drugs. Our overall hypothesis is that resources that promote increased caregiver-infant bonding and engagement at birth and in early life will blunt the long-term impacts on development of prenatal drug exposures. These efforts will lay the groundwork for future, larger grant applications that will aim to translate identified resilience-promoting resources to other communities with the ultimate goal of improving outcomes for infants experiencing the impacts of prenatal substance use as well as for those who care for them.

Specific objectives of the AIAN CTRP Grant include:

2.1.a Conducting a feasibility study to identify and evaluate positive caregiver or family-child engagement activities that may be associated with improved developmental or behavioural outcomes among children, ages 0-3 years with and without prenatal substance exposure that reside on Flathead Reservation.

2.1.b Leveraging study findings to inform a future culturally-appropriate and sustainable intervention to address substance use effects on children that reside on the Flathead reservation.

2.1.c Disseminating study findings to CSKT Partners, CAT, CSKT Tribal Council, CSKT Culture Committees, and CSKT Early Head Start families.

The Parties agree to work collaboratively in the design of future studies and to achieve the following AIAN CTRP Grant common objectives:

2.2 Aim One. Evaluate infant development associated with prenatal exposure to opioids and other substances in children between 0 and 3 years of age participating in the CSKT Early Head Start program (n=20), and their primary caregiver (n=20). *Planned activity*: Abstract child/family records to determine child developmental status, behavioural status and prenatal drug or other maladaptive exposures status to assess association between prenatal drug exposure and later behavioural and developmental outcomes.

2.3. Aim Two. Identify factors that provide resilience to the impact of prenatal substance use exposure on infants. Emphasis includes the following resilience exposures: caregiver-infant engagement, participation in cultural and native language activities, and in-hospital practices. *Planned activity*: Conduct interviews with caregivers of children between 0 and 3 years of age participating in the CSKT Early Head Start program (n=20) that assess type, amount and duration of positive caregiver-child engagement activities to determine if positive engagement improves developmental and behavioural measures.

SECTION 3: ROLES AND RESPONSIBILITIES FOR THE PROJECT

The following subsections set out the key roles and responsibilities to be delivered by each Party, including the anticipated Outputs and Outcomes:

3.1 UM's Roles and Responsibilities:

3.1.2 UM PI and Project Lead. The UM Project Lead shall have the responsibilities as described below:

3.1.2.1 Research:

a. Provide leadership on scientific methodology to ensure sound and meaningful research methods and products (i.e., upholds a high level of rigor such that research outcomes may contribute to future proposals, program development, etc.).

b. Conduct research planning, data collection and management, and analysis.

c. Provide opportunities for capacity-building and training for research methods

and product development among CSKT Partners.

d. Develop research products such as academic-level abstracts and presentations, and scientific papers for publication.

e. Develop community-level dissemination products, such as presentations for CSKT; CSKT Tribal Council, CSKT Early Childhood Services, CSKT Culture Committees and CSKT Early HeadStart families.

3.1.2.2 Administrative:

a. Arrange and schedule meetings (Research Team, CAT), send associated materials (i.e., agendas, notes).

b. Arrange Project activities as described in Section 2 in partnership with research team.

c. Maintain scheduled timeline of Project activities to ensure productivity.

d. Maintain Salish Kootenai College Institutional Review Board approvals for all human subjects research.

e. Develop funding applications for future research studies with CSKT Partners.

3.1.3 Community Research Navigator. Community Research Navigator shall have the responsibilities as described below:

3.1.3.1 Attend academic-community, CAT, and community meetings to facilitate clear communication of priorities and next steps among the academic and community research team.

3.1.3.2 Communicate and facilitate necessary steps for approval for continued research activities (e.g., Tribal Council, Culture Committees).

3.1.3.3 Review and assess the Project on quarterly basis to assure Project is on schedule to fulfill stated aims and report on Project progress to the AIAN CTRP at regular intervals.

3.1.3.4 Communicate often with community members, community stakeholders, Culture/Elder Committee members, CSKT Department Leads/Staff, and Tribal Council members to assure understanding, clarify needs or aspects of research project while addressing any concerns or questions.

3.2 ECS Roles and Responsibilities:

3.2.1 CSKT Project Lead. The CSKT Project Lead shall have the responsibilities as described below:

3.2.1.2 Engagement and Administrative:

a. Provide leadership and guidance for all local Project activities (Flathead Reservation) – maintains communication with CSKT Early Childhood Services to ensure approval for research activities and products.
b. Voice ECS priorities for Project participation, provide guidance to team on how activities can best align with ECS priorities and practices.

c. Schedule local spaces for team meetings, accessing resources (e.g., technology, communication) as needed.

d. Provide recommendations for tribal approval process(es) as needed through, as appropriate, ECS, the Salish Kootenai College Institutional Review Board, Tribal Council, and/or the Culture Committees.

e. Participate in local-presentation(s) of Project.

f. Assist with plans for dissemination including obtaining reviews and approvals of items to be presented or published.

3.2.1.3 Research Activities. CSKT Project Lead will designate ECS staff (e.g., Family Advocates) to support the following activities:

a. Study recruitment by disseminating recruitment postcard through various outlets (e.g., in-person, email, CSKT social media, word-of-mouth).

b. Facilitate use of CSKT Early HeadStart spaces for Section 2.3 activities (interviews).

c. Facilitate file access for Section 2.2 activities (abstract behavior and developmental outcomes).

3.2.2 CSKT Partners. CSKT Partners may participate in a variety of capacities, such as:

3.2.2.1 Provide guidance and steps for the Project to abide by CSKT Early Childhood Services contracts and grant requirements.

3.2.2.2 Provide insight into best practices for research with AIAN families.

3.3 Project PI Roles.

Project PI shall provide overall research leadership and guidance to academic study personnel, including direct oversight and mentoring to the UM Project Lead.

3.4 Amendment.

The Parties may, from time to time, agree in writing to adding or changing roles and responsibilities in relation to the Project, in which case such activities shall be subject to this MOA.

SECTION 4: RESEARCH, COMMUNICATIONS, MEDIA, AND ADVERTISING

4.1 Publication. The Parties may publicize the objectives and benefits of this MOA and the Grant in the following manner:

4.1.1 Any publications or presentations stemming from research performed under this MOA require acknowledgment of ECS's participation in the project.

4.1.2 The Parties agree to work collaboratively to develop a media protocol.

4.1.3 The ECS logo may be used for publication purposes upon the approval of publications (presentations, recruitment materials) by the CSKT Project Lead.

4.1.4 No Party shall issue any press release, promotional publications or written advertisement relating to this MOA and or the Grant without the prior written approval from the other Party nor imply in any way that any Party endorses or approves the other's products or services.

4.1.5 Notwithstanding the preceding provision, each Party shall recognize the participation of the other Party in promotional material, written reports, and/or manuscripts including the following: recruitment fliers and social media posts, articles in media outlets, abstracts for poster or oral presentations at national and or international scientific societies, and written publications in national and or international peer reviewed journals.

SECTION 5: INTELLECTUAL PROPERTY

5.1 Copyright. Copyright in any Materials arising from the Project created by University Personnel will be owned by the UM or person entitled to ownership in accordance with UM policies, collective bargaining agreements, and applicable federal law. The Parties agree to work in good-faith to determine authorship and ownership of copyrightable Materials in cases of joint authorship between the Parties.

5.2 License. UM and Project PI hereby grant to ECS a non-exclusive, perpetual, irrevocable,

world-wide, fully paid and royalty-free licence to use, reproduce, translate and communicate to the public the Material where UM and or the Project PI owns the copyright by any means, in whole or in part, for any ECS purpose. ECS shall reproduce UM's and or the Project PI's copyright notice, if any, on all copies of the Material, and to acknowledge the Project PI's or UM's title entitled to ownership in accordance with UM policies and collective bargaining agreements to the copyright.

5.3 Publication. UM shall provide ECS advance notice of the submission of any research resulting from the Project, and an advance copy of the text to be submitted, at least thirty (30) days prior to submission.

5.3.1 Right to Review. ECS shall have thirty (30) days after receiving such notice as described in Section 5.3 to review a manuscript or abstract by UM related to research activities under this MOA. During such thirty (30) day review period, ECS shall have the right to request and require removal of information prior to submission that: (i) identifies or could reasonably be used to identify any individual participant of the Project, (ii) characterizes CSKT or any CSKT community in a harmful way, (iii) discloses any sensitive CSKT community or cultural traditions; or (iv) presents other cultural issues/concerns. If a manuscript needs to be revised, UM shall note any changes to the initial submission to ECS, and UM shall provide ECS with seven (7) days to review the revised submission so that ECS can ensure that the manuscript does not contain any of the above described sensitive information. UM agrees to work in good-faith with ECS to remove any such information to ECS' satisfaction prior to publication.

5.4 Rights to Grant. UM hereby represents that it has or will have all necessary rights to grant the license set out above.

5.5 License Duration. Notwithstanding any provisions of this MOA, the license granted herein shall survive the termination or expiration of this MOA.

SECTION 6: DURATION

6.1 Term. This MOA is valid as of the Effective Date and will remain in effect until July 31, 2020, unless otherwise terminated or amended in accordance with the provisions of this MOA.

SECTION 7: COMPENSATION

7.1 Payment for services. The Project PI with designated funding from the AIAN CTRP Grant shall pay:

7.1.1 ECS for services in the sum of $20,000 on or before June 30th, 2020.

7.2 Payment Schedule.

7.2.1. ECS will receive a payment for services of $20,000 on or before June 30th, 2020.

7.3 Forms of Payment.

7.3.1 ECS will receive payment as a subrecipient for contracted services.

SECTION 8: AMENDMENT AND TERMINATION

8.1 Amendment. This MOA may be amended by written consent of the Parties.

8.2 Termination. Upon material breach of this MOA by the other Party, a Party may terminate this MOA after no less than thirty (30) days from the date of written notice to the other Party of intent to terminate the MOA. Such written notice must clearly specify the nature of the material breach. Only if the allegedly breaching Party neither remedies such breach nor satisfactorily demonstrates that no material breach took place within this thirty (30) day period may the noticing Party proceed to terminate the MOA. Such notice of actual termination must also be in writing.

SECTION 9: PRINICIPAL CONTACTS AND NOTICES

The principal contacts for this MOA are listed below. All notices shall be addressed accordingly to the principal contacts of each Party.

University of Montana: Erin Semmens Associate Professor School of Public and Community Health Sciences University of Montana 32 Campus Drive Missoula, Montana 59812 erin.semmens@mso.umt.edu (406) 243 - 4446	CSKT Early Childhood Services Jeanne Christopher Department Head CSKT Early Childhood Services Neil Charlo Building St. Ignatius MT, 59865 jeanne.christopher@cskt.org (406) 745 - 4509

SECTION 10: EXECUTION

10.1 No Implied Authority or Relationship. Nothing in this MOA shall constitute or imply any partnership, joint venture, agency, fiduciary relationship or other relationship between the Parties other than the understanding expressly provided for in this MOA. Neither Party shall have, nor represent that it has, any authority to make any commitments on the other Party's behalf.

10.2 Reliance. Each Party enters this MOA without relying on any representation, warranty or other provision except as expressly provided in this MOA. Any addition, deletion or variation to the provisions of this MOA shall be inapplicable unless it is agreed to in writing and signed by the Parties.

10.3 Counter Parts. This MOA may be executed in any number of counterparts and by the Parties
in separate counterparts. Each counterpart when so executed shall be deemed to be an original and all of which together shall constitute one and the same document. The Parties may treat signed electronic, digital, or facsimile copies of this MOA as originals.

10.4 Governing Law, Forum, and Attorney Fees. This agreement is intentionally silent on matters pertaining to choice of laws, jurisdiction, venue, and attorney fees.
10.5 Entire Agreement. This MOA supersedes all prior agreements, whether written or oral, between the Parties with respect to its subject matter and constitutes the entire and exclusive statement of the terms of the agreement between the Parties with respect to its subject matter. Amendments to this MOA shall be in writing and signed by both Parties.
10.6. Severability. If any provisions of this Agreement are declared invalid by a court of competent jurisdiction, the remaining provisions shall not be affected thereby.

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed under seal by their duly authorized representatives.

FOR: UM	**FOR: CSKT ECS**
By: _____	By: _____
Name: _____	Name: _____
Title: _____	Title: _____
Date: _____	Date: _____

APPENDIX C. Study 2 Recruitment Flyer

Are you a parent or primary caregiver to a child ages 0 – 3?

Do you have a drug free home?

If YES, you may be eligible to participate in a study being conducted by the University of Montana.

University of Montana – Family Engagement Study

UM Researchers are conducting a study aimed at identifying factors that promote resilience to the effects of prenatal substance use exposure and are interested in interviewing caregivers of children with and without such exposure.

Eligible participants include primary caregivers to a child between 0 and 3 years of age, residing in a home on the Flathead Nation that is currently drug-free. Caregivers with children with no drug exposure are also welcome to participate in this study! Your participation and the information gathered from the interview will remain confidential.

Interviews are expected to last up to 1.5 hours. Participants will receive $50 for their time. Snacks and drinks will be provided, and childcare will be available!

For more information call or text:

(406) 262-4860

CSKT Council Approval: 3/19/2019 SKC IRB Approval: DATE

APPENDIX D. Study 2 Semi-structured Interview Tool

Date, Time: _____ Location: _____ Audio or Hand-written (circle) PID: ____ Interviewer: ____

Table 1. Interview Guide: Domains and Subtopics for Family-Child Engagement Activities

Family type (circle one): Biol-parent drug-exp child Caregiver drug-exp child
Caregiver no drug-exp child Biol-parent no drug-exp child

DOMAIN: COMMUNITY/CULTURAL ACTIVITIES

PART I: AVAILABILITY OF COMMUNITY/CULTURAL ACTIVITIES

1.1 What are all of the community available to families that you can think of that are kid-friendly (0-3 years old)? (Probe: List programs, such as ECS, THD, Social Services, that host community events) (Prompt: basketball, football, fair).

1.2 What are all of the cultural practices that are available to your family that you can think of that are kid-friendly (0-3 years old)? (Prompt: round dances, powwow, sweats, language programs)

1.3 Of the cultural and community activities that you know about, which activities does your child get to do?

1.3.1 [If activities mentioned in 1.3] What positive outcomes, if any, does your child receive participating in [ACTIVITY]? (Prompt: connectedness, cultural knowledge)

1.4 Do you participate in any of the available services or program events through Early Childhood Services? (Probe: Services - Salish Language Nest, Early Headstart, Home Visiting-Education, Home Visiting-Family Advocate; Events: Cultural activities at parent meetings)

1.4.1 [If "Yes" to 1.4] What positive outcomes, if any, do you and your child receive participating in [ACTIVITY]? (Prompt: connectedness, cultural knowledge)

1.5 Do/Did you participate in any of the available services or programs through Bridge To Hope/Wrapped in Hope? (Probe: Bridge to Hope classes "Parent Curriculum", counseling)

1.5.1 [If "Yes" to 1.5] What positive outcomes, if any, does/did you and your child receive participating in [ACTIVITY]? (Prompt: connectedness, knowledge)

PART II: BARRIERS TO COMMUNITY/CULTURAL ACTIVITIES

2.1 What barriers, if any, exist for you and your child to participate in these community or cultural activities? (Prompt: not know of engagement opportunities, not a part of family involved in cultural activities, time, cost, not from community) (Probe: Mention these events Baby Fair, W4W, M4W, Breastfeeding week)

2.2 Do you feel that your child receives enough supports from your community or cultural leaders? (Probe: Elders, community organizations)

2.2.1 [If "No" to 2.2] What are some reasons that you think your child does not get enough support? (Prompt: see 2.1 prompt)

2.3 What would be your top 3 community and/or cultural activities that you would like to do with your child?

PART III: FACILITATORS TO COMMUNITY/CULTURAL ACTIVITIES

3.1 What supports, if any, exist for your child and your or another family member to participate in community activities? (Prompt: feeling accepted, family member presence, transportation, childcare, family/friend(s), community resources, time and location, no-cost event)

3.2 What supports make it possible for your child to participate in cultural practices? (Prompt: See 3.1 prompt)

3.3 What supports, if any, are not available, but could support your child to participate in community or cultural activities? (Prompt: see 3.1 Prompt)

DOMAIN: OUTDOOR ACTIVITIES

PART IV: AVAILABILITY OF OUTDOOR ACTIVITIES

4.1 What are all of the common outdoor activities in your community that you can think of that are kid-friendly (0-3 years old)? (Prompt: Swimming, berry-picking, nature walks/hiking , backyard play, park, walk neighborhood, camping, fishing, community gardens, Farmer's market, fishing derby/Mack days)

4.2 What outdoor activities, if any, do you or another family member like to do with your child during the summer? (Prompts: See 4.1 prompt)

4.3 What do you think are the top 5 most important outdoor activities that you or another family member(s) do with your child? (Probe: Clarify on importance in terms of child well-being)

4.3.1 [If activities mentioned in 4.3] What do you think are the benefits, if any, that your child receives? (Prompt: knowledge, bond, happy, laugh, soothing)

PART V: BARRIERS TO OUTDOOR ACTIVITIES OF INTEREST

5.1 What barriers, if any, exist for you and your child to participate in these outdoor activities available in your community? (Prompt: safety, time, transportation, cost, attitudinal barriers, community resources, location)

5.2 What would be your top 5 outdoor activities that you and your child would like to do?

PART VI: FACILITATORS TO OUTDOOR ACTIVITIES OF INTEREST

6.1 What supports, if any, exist for your child and you or another family member to do outdoor activities? (Prompt: transportation, supportive neighbors, presence of family members, community resources)

6.2 What supports can you think of that are not available, but could support your child and you or another family member to do outdoor activities? (Prompt: see 6.1 Prompts, safe bike/walk paths)

DOMAIN: HOME ACTIVITIES

PART VII: AVAILABILITY OF HOME ACTIVITIES

7.1 What types of in-home activities do you or another family member(s) do with your child? (Prompt: Story-telling, read, sing, play, have dinner together)

7.1.1 [If activities mentioned in 7.1] What do you think are the benefits, if any, that your child receives? (Prompt: connectedness, cultural knowledge, happy, laugh, soothing)

7.2 What do you think are the top 5 most important at-home activities that you or another family member(s) do with your child? (Probe: Clarify on importance in terms of child well-being)

7.2.1 [If activities mentioned in 7.3] What do you think are the positive outcomes, if any, that your child receives? (Prompt: knowledge, bond, happy, laugh, soothing)

PART VIII: BARRIERS TO HOME ACTIVITIES

8.1 What barriers, if any, exist for your child and you or another family member to participate in at-home activities? (Prompt: time, cost, fussy, lack of family/friend member presence, overcrowded)

8.2 Do you feel that your child receives enough attention from you and family member(s)?

8.2.1 [If "No" to 8.2] What are some reasons that your child does not get enough attention? (Probe: Mention technology (phone, Netflix/TV, gaming) distraction, time, lack of family member presence, tired, out-of-house (gamble, shop))

8.3 What would be your top 5 inside activities that you and your child would like to do?

PART VIIII: FACILITATORS TO HOME ACTIVITIES

9.1 What supports make it possible for you or another family member and your child to do in-home activities? (Prompt: family member presence, supportive neighbors, community resources, personal/family income)

9.2 What other supports that you can think of that are not available, but could support you or another family and your child to do in-home activities? (Prompt: see 9.1 Prompts)

DOMAIN: FAMILY DEMOGRAPHICS

7.1 Please estimate how many family members spend time with your child in a typical week:

7.2 How many children (e.g., siblings, cousins) does your child have that live in the home?

7.3 What is your relationship to your child? (Prompt: biological father, foster parent, non-biological parent)

7.4 What is your child's primary race?

7.5 What is your primary race?

7.6 What is your age?

7.7 List all known drugs, if any, your child was prenatally exposed to: